PROCEEDINGS

OF THE

TWENTY-FOURTH GENERAL MEETING

OF THE

NATIONAL VETERINARY ASSOCIATION,

HELD AT

THE UNIVERSITY, LIVERPOOL,

ON

July 25th and 26th, 1906.

H & W. Brown, Printers, 20 Fulham Road, London, S.W.

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1906.

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Stafford Jackson
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W. J. Fletcher

Mr. F. G. Edwards
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Thos. Dobie, Junr.
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Also The Pres. and Sec. of the
Liverpool Univ., V.S.
Lancashire V.M.A.
North Wales V.M.A.
Yorkshire V.M.A.

Local Secretary, Mr. Arnold Richardson.

Trustees.

Messrs. F. W. Wragg ; R. C. Trigger ; J. F. Simpson, J.P.

Auditors.

Messrs. S. Villar and J. Macqueen.

Treasurer.

Mr. F. W. Wragg, Whitechapel, London.

Secretary.

Mr. W. Hunting, London.

The Annual Meeting in 1905 was held at the Town Hall, Buxton, on July 25 and 26, under the Presidency of R. C. Trigger, Esq., J.P.

The proceedings were published and issued to all the members.

A Council Meeting was held at Liverpool on November 7th, at which the Provisional Committee was elected.

A Council Meeting was held in London on June 6th, at Red Lion Square, at which delegates were selected to the Public Health Congress at Cork, and to the Sanitary Congress at Bristol.

The Provisional Committee have made all arrangements for the Annual General Meeting at Liverpool on July 25th, 26th and 27th, and drawn up the following order of proceedings.

Dr. *F. W. WRAGG, Treasurer, in account with The National Veterinary Association* **Cr.**

1905-6	£	s.	d.	£	s.	d.
To Balance				191	4	1
„ 217 Subscriptions ...	113	18	6			
„ 48 Arrears	25	4	0			
„ 1 Life	5	5	0	144	7	6
„ Three-quarter Year dividend on £300 Consols				5	7	0
				£340	18	7
To Balance	103	19	0			
Amount invested in Consols	400	0	0			

1905-6.	£	s.	d.	£	s.	d.
By Printing, General Secretary ...	47	1	6			
„ „ Local „ ...	5	18	6	53	0	0
„ Postage, General „ ...	9	3	0			
„ „ Local „ ...	1	0	0			
„ „ Treasurer ...		17	6	11	0	6
„ Grant to Annual Dinner ...				10	0	0
„ Expenses, Annual Meeting ...				5	3	2
„ Hire of Rooms				3	18	6
„ Delegates Fee, Congress, Budapest					17	0
„ Delegate's Expenses, Mr. Malcolm				26	5	0
„ Secretary's Expenses, Buxton ...	2	10	0			
„ „ „ Liverpool	2	18	0	5	8	0
„ Advertising				3	5	0
„ Reporting				26	10	8
„ Delegate's Fees, Royal Sanitary Institute				2	2	0
„ Delegate's Fees, Institute Public Health				1	1	0
„ Purchase of £100 Consols ...				88	8	9
„ Balance				103	19	0
				£340	18	7

Audited and found correct,

SIDNEY VILLAR,
JAMES MACQUEEN, } *Auditors.*

National Veterinary Association.

Meeting at Liverpool,

On July 25th, 26th and 27th.

President: W. OWEN WILLIAMS, Esq.

ORDER OF PROCEEDINGS.

FIRST DAY (Wednesday, July 25th.)

10 a.m. General Meeting at the University.
Reception in the Tate Library by the Lord Mayor and The Vice Chancellor.

10.30 Adjourn to the Arts Theatre.
Address of Welcome by Vice Chancellor Dale.
President's Address.

11. Paper on "**Contagious Abortion,**" by Professor Bang, (Copenhagen.)
Discussion opened by Principal Mettam.

1 p.m. Adjourn for lunch.

2.30 Continuation of Discussion on Professor Bang's Paper.

3. Paper on "**Animal Diseases Following War,**" by Lt. Col. Hazelton.
Discussion opened by Stafford Jackson, M.R.C.V.S.

7. Annual Dinner at Adelphi Hotel.

SECOND DAY (Thursday, July 26th.)

10.30 a.m. Paper on "**Public Health and Veterinary Science**" by Professor Boyce, M.B., F.R.S.

Discussion opened by T. Eaton Jones, M.R.C.V.S.

1 p.m. Adjourn for Luncheon.

2.30 Paper on "**Insects and Ticks in relation to Animal Diseases,**" by R. Newstead, A.L.S., F.E.S.

Discussion opened by T. B. Goodall, F.R.C.V.S.

FRIDAY, July 27th.

10.30 a,m. By boat, Starting from Liverpool landing stage: train 10.45 from Woodside, Birkenhead, to Chester; arriving 11.20. View Chester's Antiquities and Cathedral, conducted by Mr. R. Newstead. Luncheon at the Grosvenor Hotel 1 p.m. Leave Chester 2.30 by boat for Eccleston and Eaton Hall. Tea at Eccleston Ferry at 5 p.m. Leave Eccleston 6.30. Arrive Chester 7.15.

Visitors preferring the seaside could stay at West Kirby, Hoylake, New Brighton or Southport. All within 30 minutes of Liverpool.

An Exhibition of Drugs and Instruments will be held during Days of Meeting.

TWENTY-FOURTH GENERAL MEETING,

Held at The University, Liverpool, July 25th and 26th,

Prof. W. O. WILLIAMS, President, in the Chair.

Members present: Messrs. J. Abson, C. Allen, G. A. Banham, F. W. Barling, J. J. Bell, W. H. Bloye, H. G. Bowes, A. S. Brooksbanks, J. J. Burchnall, A. L. Butters, J. Cameron, W. S. Carless, J. H. Carter, J. T. Potter Carter, A. H. Darwell, F. G. Edwards, W. T. Edwards, W. A. Elder, E. Faulkner, T. C. Fletcher, A. B. Forsyth, F. W. Garnett, J.P., M. T. Giblin, W. W. Grasby, M. Hedley, A. Holburn, J. Holland, T. Hopkins, G. Howe, R. Hughes, W. Hunting. Stafford Jackson, J. C. James, T. Eaton Jones, W. Kendall, A. Levie, J. S. Lloyd, G. H. Locke, S. Locke, S. Lomas, A. Inglis Mac Callum, J. Mc I., McCall, J. R. McCall, J McGavin, Prin. A. E. Mettam, A. Munro, A. Over, A. Porritt, T. G. Price, T. S. Price, A. Richardson, H. L. Roberts, M. Robinson, R. Rutherford, F. G. Samson, S. E. Sampson, J. E. Scriven, W. Shipley, S. H. Slocock, A. Spreull, Lt.-Col. C. Steel, E H. Stent, H. Sumner, W. A. Taylor, J. Temple, J. Thomson, Capt. A. G. Todd, R. C. Trigger, F. J. Tucker, W. R. Williams. A. Wilson, E. Wood, W. Woods, Prof. G. H. Wooldridge, F. W. Wragg,

Hon. Members: Dr. B. Bang, Prof. R. Boyce.

Visitors: Messrs. J. Clarkson, A. Culiham, T. Dobie, Maj. F. Eassie, W. J. Fletcher, J. Godber, Lt.-Col. E. H. Hazelton, G. O. Ogden, A. Walker, J. H. White, F. J. Winchester.

First Day. Wednesday, July 25th, 1906.

At 10 a.m. a reception was held in the Tate Library by the Lord Mayor of Liverpool (Alderman Joseph Ball) and the Vice-Chancellor of the University (Dr. Dale). At the conclusion of the reception the Lord Mayor made the following remarks:—Gentleman, at the beginning of your Conference in this city, I desire on my own behalf, and on that of the citizens of Liverpool, to extend to you a very cordial welcome. You are coming here, I understand, to confer with one another on the great subject in which you are so much interested—the study of all that concerns the welfare of veterinary science.

Great strides have been made in the science of recent years, and Liverpool and the Northern Counties have come out well in this matter.

I trust that your deliberations may be productive of much good. If you can discover remedies for the ills to which the animal world is prone, or if you can improve the existing conditions in any way, I am sure your labours will not be in vain.

You are in a city, which, I venture to boast, is no mean one, and if you have any spare time away from the labours to which you have set your hands, I trust you will take the opportunity of visiting places of interest which Liverpool people will be only too glad to show you in our midst.

A Lord Mayor has to speak upon all sorts of subjects, but I must confess to being particularly ignorant of the details of veterinary science. I regard myself as a mere outsider, although one who approves of every effort on behalf of man or beast whereby pain may be reduced, and happiness and comfort enhanced.

With this sentiment I wish you the most cordial success in your meeting, and I trust you will go away from Liverpool with the happiest recollections of your visit here (Cheers).

An adjournmeni was then made to the Surgical Theatre of the Medical School, where the following address of welcome was delivered by Vice-Chancellor Dale :—

Mr. Abson, Ladies and Gentlemen, the Lord Mayor has already welcomed you in the name of the city. It now falls to me to give you as hearty a greeting on behalf of the University. But the Lord Mayor might have spoken as the representative of both, for here in Liverpool the University is not an institution standing apart from our municipal life. It is a University in the city, of the city, and for the city ; it owes its existence to civic enterprise and civic enthusiasm. It is one of the many forms in which the patriotism of the place displays itself.

And so you will understand that the University of Liverpool is bound to take a special interest in that branch of medical science with which your Association is identified. The interests of the city in which we are set for service would make indifference not merely foolish but criminal. Our position—at the gate of the sea—puts us in touch with the men who have to deal with cattle in all parts of the world. And the part that we have taken in averting disease, in guarding against it, instead of merely curing it—would in itself be a sufficient force to ensure our sympathy for your work, and our co-operation in all that may help to promote its efficiency and its advancement.

It would ill become me to boast of what we have already done. Our School of Veterinary Medicine is a new school, a young

school: it is in its childhood, not in its maturity. But it has taken root; and while it receives strength from other departments in our organic whole, it repays the debt and helps to strengthen the institution of which it is a part. We already have one Professorial Chair of Veterinary Medicine and Surgery, filled by your President, Prof. Williams, whose enforced absence we sincerely regret. But we have felt, from the outset of our venture, that a single Chair was not enough, and the University Council, at its last meeting, determined to establish a second Chair dealing with that science of Comparative Pathology which is the basis and foundation of the most enduring and fruitful work (Cheers). This new Chair is not yet filled; and I must not forecast the future. But I may venture to say this, that when the appointment is made—as it will be in the early autumn—we are confident that we shall find a man to fill the Chair who will add fresh strength to the school, and will command the confidence of all who are concerned in the various branches of the same work (Cheers).

Hitherto, I say, we have had but one Chair, but the Professor does not stand alone. He has active and able colleagues in Dr. Annett and Mr. Share-Jones. And we have received untiring and ungrudging help from the men whom we have associated with us in the work of the School—from Mr. Henry Sumner—(Cheers)—who has acted as Chairman of the Veterinary Board during the two most critical years of its existence; from Mr. Stafford Jackson, Mr. Eaton Jones and Mr. Arnold Richardson (Cheers). We may not have done all that we could, but without them, without their knowledge, their experience, their self-sacrifice—we should never have done anything at all.

In saying this I do not forget the services of other colleagues. The strength of a School like this, established in connection with a University, and as a part of it, lies in the fact that it can command the services of the whole University staff—of men like Prof. Boyce (Cheers) who has been the moving force in the enterprise from the beginning until now; men like Professor Herdman, and Prof. Sherrington, whose work is known by men of science in all lands and honoured as widely as it is known; and men like Prof. Hope and Dr. Mussen who are doing a great work for the whole population of this vast city. We have the men to make a strong school, and I am confident that they will make it. Now that you have been here and seen it with your own eyes, it will have your good will, and such help as you can give it. There is one question closely connected with the interest of the School, and of other Schools as well, to which I must briefly refer before leaving to keep another important engagement:—I mean the establishment of special degrees in

veterinary medicine and surgery. It is an open, an unsettled question, with us; though the Council and Senate have resolved that the time has come to establish such degrees. And in anything that I may say, I shall speak for myself and for myself alone. But there are two principles, so it appears to me, that we are bound to keep in mind in any action that we may take. The first is that we must do nothing that would weaken or destroy the system established in veterinary medicine, of a single and uniform professional qualification (Cheers). When this principle has been violated the result has been confusion—I might almost say chaos. It is easier to retain than to restore: and I trust that nothing will be done either in England or in Scotland to impair a system that is sound in reason, and that has proved efficient in practice (Cheers).

And the second principle is this:—that the value of the degrees that a School confers depends on the strength of the School that confers them. To establish degrees with the idea of recruiting a school, of making a school attractive, of winning reputation for it, is a policy, to my mind, unsound, unwholesome and fraught with peril. It is the wine that makes the brand—not the brand that makes the wine; and we shall brand our bottles in vain, unless the bottle comes from a vineyard of renown, and unless it holds a vintage wine within it (Cheers).

As I told you, I speak for myself—not for others. And in so speaking, I do not attempt to forecast the decision of the future. But these are principles to which I hold, and even if they do not command your sympathy, I trust that you will consider them, and weigh them, before you criticise or condemn.

And now, I end where I began—with the hope that this conference may fulfil its purpose; that it may be rich in result and pleasant in memory; and that if you do not find it possible always to abide in unity, you may feel that it has been a good thing to have taken counsel together (Cheers).

We welcome you all, but we welcome especially any who, like Professor Bang, have come from other lands; because we believe that comradeship in effort to extend knowledge and to diffuse light—to lessen suffering and to increase health—in whatever part of creation that effort may be—will lay the foundations broad and deep of that universal brotherhood and that world wide peace which are the hope and vision of many hearts (Cheers).

Mr. Abson: Ladies and gentlemen, I beg to propose a very hearty vote of thanks to Dr. Dale, the Vice-Chancellor of this University, for the most able and interesting address which he has delivered to us (cheers).

The resolution was carried by acclamation.

Dr. Dale : Mr. Abson and gentlemen, may I thank you in one word for listening to me so patiently.

(Dr. Dale then withdrew, and the ordinary business of the meeting was proceeded with, Mr. Joseph Abson, Vice-President, occupying the chair).

The Chairman, who was received with cheers, said: Ladies and gentlemen, owing to the regrettable absence of Professor Williams, our President for this year, through indisposition, I have been asked to take his place. I am sorry that the Presidential address will not be forthcoming this year, but I think the address we have had from Dr. Dale will perhaps compensate in some manner for the loss of Professor Williams' address. The first business is to fix the place of meeting for next year.

Mr. Hunting: *(Sec.)* The Council always considers these matters the night before, as required by the rules, and make a recommendation to this meeting. Last night the Council met, and had before it an invitation from the Eastern Counties inviting us to hold our next meeting there; and the Council suggests to this meeting that the place of meeting next year should be Yarmouth.

Mr. W. Shipley: I have very much pleasure in moving that Great Yarmouth be the place of meeting for the year 1907.

Mr. F. W. Wragg: I have much pleasure in seconding that.

The resolution was put and carried unanimously.

Election of President.

The Chairman: The next business is the election of President for the ensuing year.

Mr. S. Locke: I beg to propose that Mr. William Shipley be President for next year.

Mr. J. H. Carter: I second that.

The resolution was put and carried with acclamation.

Election of Six Vice-Presidents.

Mr. Hunting: The Council recommend that the following gentlemen should be elected as Vice-Presidents:—

Messrs. E. H. Leach, Charles Hartley, T. A. Rudkin, Stewart Stockman, W. Grasby, and John Hammond.

Mr. M. Hedley: I beg to move that the recommendation of the Council be adopted.

Mr. J. H. Carter: I second that.

The resolution was put and carried unanimously.

Election of Council:

The Chairman: The names suggested for the Council are Messrs. J. G. Parr, J. B. Martin, H. L. Roberts, J. Macarthur, A. Over, E. G. Crowhurst, T. Spencer, J. A. Todd, H. Buckingham, G. A. Banham, G. H. Gibbings, and F. G. Samson.

Mr. R. Hughes: I beg to move that these gentlemen be elected.

Mr. Price: I beg to second that.

The resolution was carried unanimously.

Election of Secretary and Treasurer.

The Chairman: I do not think we can do much better than re-elect the gentleman who at present hold these positions.

Mr. J. S. Lloyd: I beg to move that.

Mr. J. McI McCall: I second that.

Mr. Hedley: I should like to support it.

The resolution was then put and carried by acclamation.

Election of Life Vice-President.

Mr. F. W. Garnett: I should like to propose that our late President, Mr. R. C. Trigger, be re-elected a Life Vice-President of this Association (Cheers). I am sure we all remember the splendid work he did for us at our last annual meeting, and I am equally sure it will be the pleasure of the members that this honour should be conferred upon him (Cheers).

Mr. E. Faulkner: I second that.

The resolution was then put and carried with acclamation.

Mr R. C. Trigger: Mr. Chairman, Mr. Garnett, and gentlemen, I am sure I hardly know how to thank you for the signal honour that you have conferred upon me, the more so that my duties, I am afraid, were very inefficiently performed owing to the state of my health (No, no). I am thankful to say that I am in far better health now, and I hope I may be able to do better work as a Vice-President than as President. I thank you very heartily indeed for the honour you have conferred upon me, and I should like to add that the Presidency was one of the most pleasurable offices I have ever held in the veterinary profession (Cheers).

PRESIDENTIAL ADDRESS.

Mr. Vice-Chancellor, Ladies and Gentlemen, after receiving such a hearty welcome to Liverpool by his Lordship and the Vice-Chancellor, I feel sure that all the members of the National Veterinary Association feel highly gratified and will desire me in a word to thank you Mr. Vice-Chancellor for that hearty welcome.

It may be of some interest to those who are not members of this Association to learn that it is a peripatetic body, it has no home, it has no office, and it has only one really working official, namely, its Honorary Secretary—Mr. Hunting, who seems to have the happy knack and ability to pay a flying visit to the particular centre fixed upon for the next Annual Meeting—to gather round him members of Council—to form a district committee, and then

return home and wait developments; these developments have up to now always been great successes, and the reason of that is due to the tact, urbanity, and knowledge of men, possessed by our Secretary.

You will all have perused the programme of our proceedings for the next two or three days, and, I trust, are well satisfied. The most important items are the four papers contributed by four most knowledgable gentlemen. It would be invidious, as well as absurd, to try and compare the values of these contributions: they are all equally of very great value not only to the veterinary profession but to the world at large. They are all contributed with a treble object in view. Firstly, for the alleviation of suffering in the lower animals. Secondly, for increase of protection both in animals and man. Thirdly, for the conservation of the public and private purses.

It seems to be an established custom of this Association that the President should deliver an address. Why, I know not—surely it is a sufficient honour for any man to preside over such an assembly as the one before me now, without spoiling that pleasure by having to deliver a speech?

The most remarkable fact of the time which presents itself to everyone—of even comparatively young age, is the enormous advances which have been made in science during the last decade or two. To simply mention radium, Röntgen rays, wireless telegraphy, telephony, aeroplanes, electric cars, motor cars, submarines, turbines, and so on, is enough to stupefy some people, particularly such as a very prominent man who not very long ago emerged from a long spell of absence from the world—much in the same kind of way as Rip Van Winkle when he woke from his long sleep.

But supposing we were able to abstract, say from Prof. Bang, Prof. Ronald Ross, Prof. Sir John M'Fadyean, Prof. Boyce and a few more of that particular class of scientists, I say to abstract from these savants all they have discovered and learnt regarding pathology during the last decade, and then to-day hand them the very latest text books on pathology, bacteriology and parasitology as well as cytology, they will agree that they have still further added to their knowledge. It would, I think, afford us all much amusement and cause us much wonder when they each and all found they were perhaps a day behind some authors, and a day in front of others. I can imagine Major Ross saying ten or twenty years ago, "What! get rid of malaria by draining and oiling the ditches and stagnant pool? Preposterous!

I wonder what old Prof. Dick would say—who upheld that neither rabies nor rinderpest were contagious, if he were granted a few weeks return to this sphere to find that they no longer exist in this country!

No doubt during the next decade, when the chemist and the botanist have made up their minds to specialize in discovering the special foods of the saprophytes and the various botanical groupings of these parasites, we shall, in a much better measure, be able to say exactly what processes are gone through by animals which are being immunised from one or other specific disease. I feel sure that this field is not nearly sufficiently exploited by the chemist. I am of opinion that the blood of each individual species of animal differs, and that each of these bloods contains, as identifiable chemical compounds, the various special pabula for the various organisms which give rise to specific disease, and I further think that when anyone of these special pabula enters into compound with saprophytes or with other specially prepared chemical compound, that pabulum loses its chemical identity and is so lost, so that if similar organisms enter the blood stream after that event they would be unable to find their special pabula, and would consequently die without having had the opportunity of causing their own special disease.

One of the most remarkable recent discoveries has been "opsonins" and a very clear statement in regard to "opsonins" is contained in Dr. Geo. N. Ross's address delivered recently in Birmingham, and in which Dr. Ross states the following, as taken from the *British Medical Journal* :—

"In the early part of 1903 Wright and Douglas, of St. Mary's Hospital, London, approached the problem of phagocytosis from a totally different standpoint. They first separated the corpuscular from the fluid elements of the blood. That is to say, they obtained leucocytes suspended in a neutral medium instead of in the blood plasma, and the blood plasma (or blood serum) free from leucocytes or erythrocytes. They prepared an emulsion of staphylococci in normal salt solution, and found that if they brought together only the leucocytes and the staphylococci, practically no phagocytosis occurred, but that the addition of blood plasma (or blood serum) to the leucocytes and the staphylococci effected some change so that phagocytosis did occur. The obvious deduction was that the leucocyte by itself was impotent, and further that the blood plasma contained some substance which was essential to the attainment of phagocytosis.

"Using ingenious methods of their own device, they investigated the blood plasma in order to determine the characters of this phagocytic element, and the following are the most important of their conclusions :

1. The substance so essential to phagocytosis does not act upon the leucocytes (as a stimulant to the leucocytes for example) but it combines with the micro-organisms and prepares them for phagocytosis : hence the name *opsonin*, from *opsono*, I cater for, I prepare victuals for. The conception of their mode of action is that the opsonins are carried in the lymph to the nest of microbes

which are responsible for the morbid process; that they chemically unite with the micro-organisms, and that then, and not until then, the leucocytes have the power of enveloping and destroying these micro-organisms. Thus it follows that the amount of phagocytosis which is observed is a measure of the quantity of opsonins present in any particular plasma, and does not represent the vital activity of the leucocytes.

2. The opsonins in a normal serum are almost completely destroyed by heating for ten minutes at 60° C.

3. The opsonins have been shown to be distinct from the bacteriolysins, the agglutinins, and the antitoxins.

Moreover, as shown by Bullock and Western, the opsonins have a high degree of specificity. For example, the blood of a person may contain half the normal quantity of opsonins necessary to combat a tuberculous infection such as tuberculous cystitis, and yet contain a normal amount of opsonins that have to do with an invasion of staphylococci such as causes furunculosis.

"*Leucocytes.* Wright and Douglas have shown by a striking experiment how invariable a factor the leucocyte really is. They obtained leucocytes both from an immunized patient and also from a normal individual. To a specimen of each of these they added some normal serum and also some staphylococci, and allowed phogocytosis to take place. They found that in the presence of normal serum the leucocytes of the immunized patient took up just as many staphylococci as the normal leucocytes in the presence of the same normal serum. They next took two portions of a suspension of normal leucocytes to which had been added some staphylococci, and mixed with one of these portions some serum from the immunized patient, and with the other some normal serum, and allowed phagocytosis to take place, They then found that the leucocytes to which had been added the serum from the immunized patient, took up about one-half as many styphylococci as did the leucocytes to which the normal serum had been added. This affords striking testimony that the leucocyte is an indifferent or a constant factor in the phenomenon of phagocytosis. The amount of phagocytosis observed, therefore, represents the quantity of opsonins present in the blood. So far as we can tell at present, plasma has nothing to do with the "quality" of the leucocytes.

"*Bacterial Infections.* Certain generalizations have emerged from the investigation of numerous cases.

1. If the bacterial infection be strictly localized, the opsonic index of the blood, as concerns the particular microbe causing the infection, is below normal. For example, the blood of a patient who is suffering from furunculosis will probably show an opsonic index of about 0.6 to the infecting micro-organism, that

is, to Staphylococcus pyogenes ; or, again, the blood of a patient who is suffering from tuberculous glands in the neck will probably show an opsonic index of about 0.7 to the tubercle bacillus. In each case, the patient's blood is compared with the blood of a normal man.

2. The second generalization has to do with those infections which are not strictly localised. In such cases the opsonic index will be found high at one time and low at another ; that is, the opsonic index in systemic infections tends to fluctuate from high to low. This characteristic is well shown in cases of acute pulmonary tuberculosis. Dr. Ross has often observed one day an opsonic index 1.6 in such a case, and an index as low as 0.6 a few days later.

These two generalisations are of primary importance both as concerns the diagnosis and the treatment of bacterial infections.

"*Treatment.* Briefly stated, the treatment of a bacterial infection, by Professor Wright's methods, consists in increasing the antibacterial substances of the blood, by inoculating the patient with dead micro-organisms of the same species that has caused and is maintaining the morbid process. This is the general principle.

"The first essential in the treatment of a given case is to learn the particular micro-organism which is responsible for the patient's infection. In a case of furunculosis, for example, we know that the Staphylococcus pyogenes is almost certainly responsible, and so with certain other localised infections the organism is well known. When, however, we have to do with an empyema, or with a cystitis, we only know that one of several organisms is the chief offender. The particular organism is isolated by ordinary bacteriological methods in pure culture and identified. The quantity of those opsonins present in the patient's blood which have to do with combating this particular micro-organism is then estimated, and is, as a rule, found to be deficient."

No doubt when "opsoninism" is thoroughly understood we shall have one of the most effectual or the most effectual method of prophylaxis ever dreamt of.

To turn to other matters, it is a matter of gratification that during the past twenty years the use of both local and general anæsthesia is becoming more and more common in our daily work. My own experience, and I think of the majority of those who constantly use anæsthetics, is that the danger is much less than in human surgery.

A topic which has only just become very prominent in the vision of the public is that of "Meat" inspection, I do not mean simply meat from the butcher, but all kinds of food stuffs.

I think it should be generally accepted that our claim as being the only fit and proper persons to inspect "meat" should be accepted without cavil, for do we not receive a special education of such extent and depth as no other profession receives in this subject? But, we are specially taught to recognise health and disease, not only in the living, but also in the dead animal, not only in oxen and sheep, but in horses, cattle, sheep, dogs, cats, swine, hares, rabbits, fowls and other beasts and birds which may be used for food of man.

There is a movement afoot at present in Scotland in which it is proposed that the Local Government Board should initiate an uniform inspection of meat stuffs by a special staff, not under the control of Local Municipalities, but under the Local Government Board of Scotland. It is stated that, as soon as The Tuberculosis Commission has terminated its labours, a similar scheme will be initiated in England. Such a scheme would necessarily involve the formation of a new department of the Local Government Board and should consist entirely of veterinary surgeons, both for administrative as well as executive work. It should be divided into at least four divisions: 1st, 2nd, 3rd, and 4th class, with pay and pension as in other departments of the Civil Service.

In conclusion, I should just like to refer to the present state of veterinary education. I remember, five-and-twenty years ago, a medical man attended College from October until the following April, he then went up for his Highland and Agricultural Society's Veterinary Diploma, which he obtained, he then paid ten guineas and purchased his diploma from the Royal College of Veterinary Surgeons, and thus became a full blown M.R.C.V.S. in less than eight months!!

To-day that is all changed, *no one* can obtain his diploma from the R.C.V.S. until he has attended twelve terms, been four years, at a veterinary school and has also passed five examinations, one prior to entering on his professional studies.

Within the past three years our Universities have awakened to the fact that we are a profession deserving recognition, and I am proud to say that this University has led the van by having a Veterinary School as part of it. Not only do our men receive University recognition, but they receive a University education, and *imprimatur*, and will ere long receive University Degrees.

Manchester University now grants a Diploma in Veterinary State Medicine to members of the Veterinary profession; London University also grants a B.Sc. to our members, this University now grants a Diploma in Veterinary Hygiene to M.R.C.V.S., and Edinburgh University is endeavouring to establish a Veterinary School in connection with it and whose graduates shall receive University Degrees.

We have I think every reason to be satisfied with our progress.

W. Owen Williams.

INFECTIOUS ABORTION IN CATTLE.

By Professor B. Bang, Copenhagen.

Ten years ago I published my and my assistant, Mr. Stribolt's investigations on the etiology of *Infectious Abortion*. Next year my treatise was also published in English in *The Journal of Comparative Pathology and Therapeutics* (Vol. X.), and for the details referring to this article I limit myself to a short review of the chief points.

In killing pregnant cows showing premonitory symptoms of abortion, but before the os uteri had opened itself, we found in the uterus, between the mucous membrane and the fœtal envelopes, an abundant odourless exudate, a dirty yellow, somewhat thin pultaceous material of a slimy, somewhat lumpy, character. This exudate contained in pure culture a short and fine bacillus, whose body contained one, two, or more rarely three granules, taking the stain more readily than the body. The bacilli lay partly free in the fluid, partly they lay in dense heaps included within large cells.

These bacilli were easily cultivated in test tubes containing serum-gelatine-agar. If such tubes were placed in an incubator there appeared after some days a great number of very small colonies, which almost only developed in a definite zone of the tubes, lying about $\frac{1}{2}$ cm. under the surface of the nutritive medium and having a thickness of from 1-1$\frac{1}{2}$ cm. This highly peculiar behaviour towards oxygen enabled us to recognise the specific bacillus even when it was present in impure cultures as it is the case when you examine the exudate covering an afterbirth which has been manually removed some hours after parturition. After opening the uterus other bacteria of course find their way to the exudate.

Moreover, we found that the bacilli throve well in glycerine-bouillon mixed with serum, if we let pure oxygen pass through the fluid and then closed the neck of the flask by means of melted paraffin, a method which we use for preparing pure cultures on a greater scale.

In order to prove that the bacillus, discovered by us, is the cause of epizootic abortion we inserted cultures of it into the vagina of pregnant cows. After a little more than two months one cow aborted, and another was killed showing evidently pre-

monitory symptoms of abortion. In both cases the uterus contained the above mentioned typical exudate, with the abortion bacilli, and in the case where we killed the cow before it had aborted the bacilli were found in pure culture. In the other case some other bacteria, namely, micrococci had already found their way into the exudate, although the examination was made six hours after the act of abortion. A pregnant ewe inoculated intravaginally a little more than two months before lambing gave birth to two living lambs, but on the surface of the much injected chorion we found specific exudate containing an immense number of the abortion bacilli.

Our experiments on cows proved the power of our bacilli to produce abortion, and as we found the bacilli and the specific exudate in all the numerous cases of contagious abortion from which our colleagues sent us specimens, there can be no doubt that the abortion-bacilli are the cause of this disease.

Although in most cases I did not find the uterine mucous membrane strikingly altered, I maintained the opinion that the epizootic abortion ought to be regarded as a *specific uterine catarrh*, because I thought it most probable that the very abundant exudate, which contained a quantity of shed epithelial cells, pus cells and detritus, was furnished by the uterine mucous membrane and not by the thin chorion. At present I do not attach much importance to the question whether the mucous membrane or the chorion is the chief furnisher of the exudate. I admit that, as a rule, the chorion shows more inflammatory alterations than the mucous membrane, and in all cases where I had the opportunity of examining the fœtus I was able to cultivate the bacilli from its intestinal contents, in some cases also from its blood and from various organs. Whether the disease begins on the mucous membrane or on the egg, the latter is probably always affected.

Infection.

I think that most people nowadays admit that *Epizootic Abortion is a contagious disease*, but as in many cases it is not an easy task to find out how the cows have been contaminated there still remains a certain doubt by many observers. For a great deal this depends upon the fact that we have as yet known too little of the way in which the bacilli enter into the body of the pregnant cow. The general opinion has been that the *sexual organs* form the port of entrance, and it is commonly believed that the infecting germs are occasionally taken in through the the vagina, the external parts of the genital organs of the cow being brought into contact with infected objects during her sojourn in the byre. Our above mentioned experiments prove

the possibility of this occurrence. But I wish to call attention to the fact that *copulation* must afford the most favourable opportunity of all for infection, as that is the only way in which a direct introduction of the virus into the uterus can be effected.

Although long ago some authors—*e.g.*, Penberthy—have spoken of the bull as a carrier of the contagion, and Sand in 1894 published several observations of this kind, communicated to him by Danish veterinary surgeons, as a rule too little importance has been attached to this way of infection. Danish and Norwegian colleagues have informed me of many cases in which abortion was evidently introduced into a hitherto sound herd by a bull that had served aborting cows. And in the year 1905 Mr. Isaachsen (Norway) in his excellent treatise on abortion published several similar observations.

One of the most striking examples, for which I am indebted to Mr. M. Poulsen (Ringsted), I have already mentioned in my first paper; since I have collected a great number and published them in *The Danish Veterinary Journal* in 1898. As Mr. Poulsen's observation is at the same time an excellent example of a successful *rational* prophylactic treatment of a new imported contagious abortion, I will quote it again.

A farmer who owned 16 cows, among which abortion had never occurred, nine years ago allowed seven of his cows to be served by a bull at a neighbouring farm where abortion had prevailed for some years; all these seven cows aborted, and no other. When the cows began to show signs of impending abortion they were immediately removed from the byre and put into another stall. By all seven cows the after-birth was retained, and Mr. Poulsen therefore had it removed by hand within 24 hours. The removal was complete in the case of six of the cows, but not in the seventh, which became emaciated and was soon afterwards sold. After the removal of the after-birth the cows were for some time daily washed out with carbolised water, and they were not readmitted to the byre until some considerable time afterwards, when they appeared to be entirely free from discharge. During the following year the six cows again became pregnant and carried their calves to full term. No case of abortion has since then occurred in this herd.

I think every one will admit that in such a case the bull has been the carrier of the contagion.

A reason why people have hitherto been less inclined to suppose that the cow has already been infected by copulation is, I suppose, the idea that the period of incubation is as a rule a short one. When the cow aborts at a rather late period of the pregnancy people will not easily suspect the bull. It is therefore of interest to see that in Mr. Poulsen's case five of the cows

aborted at ten weeks, one at three months, and only one at four and-a-half months before the normal end of pregnancy. In some other cases where the cow evi'ently was infected by the copulation it aborted four to eight weeks before the end of pregnancy, whereas in other cases it happened in the seventh month. Thus it is evident that the specific abortion catarrh has a very insidious course.

I am fully convinced that the bull is very often the carrier of the contagion, and in the struggle against the disease it is absolutely necessary to take measures for prohibiting this danger. On the other hand I know many examples where it is impossible to explain the infection in this way, and where it seems also impossible to ascribe it to an accidental soiling of the genital organs of the pregnant cow with infectious material. I especially refer to those cases, where on large farms the heifers are kept in separate byres, isolated from the cow byres, where the heifers are served by a young bull that has never been in connection with cows that have aborted, and where, nevertheless, a considerable number of the heifers abort, as it happens very often indeed.

Nocard has already called attention to the possibility that the agents of infection sometimes might be taken in through the respiratory or digestive organs.

In order to examine if the abortion bacilli were able to be introduced into the pregnant uterus in other way than through the vagina we made at first some experiments with *intravenous injection*. On two pregnant ewes we injected in the vena jugularis 18 and 8 c.c. of a bouillon-serum culture. They were both rather close to the lambing, and it may be doubtful if the small living lambs they bore came much before time, but in both cases I found on the chorion the specific exudate with abortion bacilli. Thus it was proved at least that the bacilli could be introduced into the uterus through the blood stream.

At the same time we injected into the jugular vein of a pregnant *mare* about 25 cc. of a bouillon-serum culture. Twenty-nine days later she gave birth to a very small living foal, that died on the second day. Here also there lay on the chorion a considerable quantity of the muco-purulent flaky exudate, containing masses of abortion bacilli.

This single experiment does of course not prove that epizootic abortion among mares is always determined by the abortion-bacillus, it only demonstrates that this may be the case and reminds us not to neglect precautions in order to protect mares against infection from aborting cows.

On a four year old cow coming from a farm where abortion never existed, we injected on the 12th of June, 1897, 36 c.c.

bouillon-serum culture into the jugular vein. The cow was pregnant in the fourth month. Three months later is aborted, and the after-birth was covered with exudate containing abortion bacilli.

Since that time we have made more similar experiments with cows, sheep, goats, and rabbits and produced abortion in this way.

Intravenous injection of abortion is followed by fever the first day, but the animal soon recovers, and if it is killed after the abortion there are no pathological changes in the organs except in the uterus. It is evidently only in the pregnant uterus that the bacilli find the conditions which they demand for their development.

When the bacilli can be carried to the uterus through the blood, it were also possible *that the pregnant animal could be infected through the alimentary channel.*

An eight year old cow, covered the 14th March, 1897, on a farm where abortion did not exist, we gave per os $\frac{3}{4}$ litre bouillon-serum culture on the 12th June, and on the 7th September we gave it again a good deal of exudate from an aborting cow. On the 26th of November it bore a small living calf, and the after-birth was covered with typical exudate, rich in bacilli.

Two years later we repeated this experiment under conditions which excluded every possibility of infection in any other way than through the feeding. A heifer which had lived since her first days in my laboratory, in stalls where aborting animals never came, was served by a young bull that had been under just the same conditions. About three months later we gave it three fœtal cotyledons from the after-birth of an aborting cow. Fifty-six days later the heifer aborted in the typical way. Thus by this experiment is proved in an incontestable manner that a pregnant cow may be infected by eating parts of an after-birth of an aborting animal, or fodder soiled by discharge from aborting cows. And as I shall show later, in speaking of my experiments on immunisation, I have so often used this method of infection that I am in the right to maintain that cows, as well as sheep and goats, are very easily infected in this way.

This knowledge, I think, is very important in practice. It gives us a sufficient explanation for the infection in many cases in which it was hitherto almost impossible to understand how it had happened, for instance, the common infection of heifers, kept in separate byres and served by a young bull that never was in connection with aborting cows. In such cases it is natural to suppose that the fodder has been soiled by means of

persons whose boots or shoes have been in contact with discharge from aborting cows, or perhaps by small animals which carry particles of such discharge from the infected byre. It explains also much easier than the common theory of vaginal introduction of the infection on the field.

I am inclined to suppose that the alimentary channel is indeed one of the ways in which the infection is most commonly transmitted. At least it is evidently necessary to have regard to this fact in our struggle against the abortion. It is not enough to prohibit infection by the bull, nor to clean and disinfect the hind part of the pregnant cow and the gutter behind the cows. We must also prevent the soiling of their fodder, which is indeed no easy task to fulfill.

We have every reason to believe that the abortion bacillus is a *purely pathogenic bacterium*, and has no saprophytic existence. The peculiar demand for a certain tension of oxygen makes this highly probable, and the fact that the bacillus, if we introduce it into the bloodstream, does only grow in the pregnant uterus and in the fœtus speaks for the same. But like many other pathogenic bacteria—*e.g.* the tubercle bacillus—the abortion bacillus is able to remain alive outside the animals for a very long time. I found that uterine exudate, collected in sterile test-tubes and placed in the ice chest, after seven months contained living bacilli, able to grow when we sowed them in agar-serum. The great vitality of the abortion bacilli is also illustrated by two cases, where in the uterus I found a mummified fœtus, surrounded by a large quantity of yellowish-brown, tough, tenacious exudate, containing living abortion bacilli, although the death of the fœtus had occurred respectively five and nine months before.

This great vitality of the bacillus is evidently a factor of great importance, when we have to consider *the means of combating the disease.*

Treatment.

This question must be divided in two or three; first, the treatment of the already afflicted animal, then the prophylactic measures, and these may again be divided into private and public measures.

When we know that abortion is the result of a very insidious inflammation in the uterus, which doubtless exists months before the cow shows the first premonitory symptoms of abortion, it seems scarcely probable that we should be able to stop this disease by any medicamental treatment of the pregnant cow. Brauer recommended to inject every fortnight 20-30 c.c. carbolic water (2 per cent.) in the subcutaneous tissue of all cows

pregnant in the 5th to 7th month. This method has been used in a great number of cases, but the results seem to have been rather uncertain, and it is highly probable that the good results which are published from many observers depend much more on the careful disinfection of the hind part of the cow and of the byre, which Brauer also recommended, than upon the introduction into the body of a rather small quantity of carbolic acid. On the other hand this treatment being quite innocuous there is no reason to dissuade from trying it, if anyone wants to do so. From a modern point of view it seems natural to try a serum treatment of the abortion, not only as a prophylactic but also as a curative measure, and I know that a Danish veterinary surgeon has injected pregnant cows in aborting herds with serum taken from cows which had aborted three times. I do not exactly know the results, but I do not believe they have been evident.

May be that a serum of higher antitoxic power were able to cure, or at least to communicate a certain degree of immunisation.

For the moment I think it best to limit ourselves to *prophylactic measures.* There is no doubt that in this way we can do very much against this scourge if we base our measures on the solid knowledge we possess of the nature of the disease and of the ways in which it may be communicated.

As *the uterine exudate is the chief bearer of the bacilli* it is evidently of the highest importance to *prevent this exudate from being spread in the byre.* A cow that shows premonitory symptoms of abortion should therefore as soon as possible be removed from the byre and placed in a separate stall, which could be easily disinfected after the abortion. If the cow has already given some discharge, all this must be destroyed and the cowstand carefully disinfected. If it be absolutely impossible to remove the aborting cow from the byre, it should at least be isolated as well as possible, and all care be taken to prevent spreading of the discharge in the byre.

As the fœtus itself and the after-birth also contain numbers of bacilli, both of course ought to be buried or otherwise destroyed. It may perhaps not be unnecessary to draw attention to this in cases where abortion occurs in the field. If the aborted calf is alive, it ought to be remembered that there may be abortion bacilli on its skin and in its fæces.

After the abortion the womb of the cow must be most carefully cleaned and disinfected. If the after-birth does not come it ought to be artificially removed, (this ought to be done on the first day) and the womb should be carefully rinsed with some antiseptic solution several times in the first days, as long as it is possible.

A careful disinfection of the womb is not only important as a

way of destroying the contagium in order to prevent infection of other cows, but it is also the best way to protect the cow against sterility, and against abortion in the next pregnancy—as illustrated in the above quoted observation of Mr. Poulsen.

If the womb is not disinfected there will probably remain alive in it some abortion bacilli, which will begin their fatal work again as soon as the existence of a fœtus in the uterus produces the necessary conditions for their growth.

The knowledge now acquired of the ease with which abortion bacilli infect by means of the alimentary channel, must, as already stated, make the very careful destruction of the discharge from an aborting cow a more imperative measure than ever.

The part of *the bull* as a carrier of the contagion compels us to do our utmost to prevent infection by means of copulation. A cow that has aborted should never be taken to the bull before all discharge has disappeared, and even then not until some months after abortion; and a bull from a sound herd should never be allowed to serve cows from a herd in which abortion has occurred, and *vice versa*. The custom (very common in Denmark) of keeping an excellent bull to serve the best cows of all the members of a society for the improvement of the breed, gives a great risk of spreading the disease. In such a bull society it is highly important strictly to maintain the regulation that an aborting cow is not to be served before the uterus is carefully disinfected and a long time has passed since the abortion. In the Norwegian report for the year 1903 is quoted the observation that abortion, which formerly was very common in a certain country district, almost disappeared as soon as this regulation was strictly followed.

If there is any possibility of the bull being soiled by discharge containing abortion bacilli the prepucial sack should be very carefully disinfected after copulation by means of rinsing it with a great quantity (Isaachsen says not less than 6 litres) of a tepid solution of some antiseptic fluid *e.g.* lysol $\frac{1}{2}$ - 1 % or septoform $\frac{1}{4}$ - $\frac{1}{2}$ % with soda 1 % (Isaachsen). The fluid is introduced by means of an irrigator with indiarubber tube, and most bulls agree with this little operation. This method has been used rather commonly in Denmark and Norway, and very often with good results. On some farms they not only disinfect the bull after the copulation but also before it, which does not seem to diminish the fertility. A farmer, instead of irrigation, bestrewed the penis before and after copulation with iodoform, and it is said that the abortion then disappeared (Albrechtsen.) The hairs round the orificium præputii should always be cut short and washed with antiseptic water before and after the copulation.

A circumstance not to be forgotten is that a cow that has calved at full term may nevertheless sometimes furnish a vaginal discharge that is infective. Abortion often occurs very late in the pregnancy, so it is easy to understand that sometimes the cow may carry her calf to full term although the specific inflammation exists in the womb. That this happens is not only observed by trustworthy observers, it also happened in some of my experiments. It may perhaps be assumed that in such cases the bacilli are less virulent than usual, but the possibility of spreading the disease by the discharge from such cows—also by means of the bull—ought not to be lost sight of.

Prevention.

If the farmer understands the disease he can do very much to protect his herd against it. The best means of avoiding this disease—as other contagious diseases—is, of course, to keep his herd *quite separate* from others. He should not allow his bull to serve foreign cows if he is not absolutely sure of their coming from a sound herd, and if he is obliged to use a foreign bull he ought to make the same reservation. If a farmer is obliged to buy a cow it should be kept separate from the others until it has calved at full time and without giving a suspicious discharge, etc.

Formerly many farmers tried to get rid of the disease by selling the aborting cows and buying new ones. This is a bad measure, because as a rule the imported cows will incline to aborting and thus serve as new fuel to the fire. It is wiser to keep the cows that abort and disinfect the womb carefully enough to free them from the disease. Even if this is not done the abortion will, as a rule, only recur two or three times, and the damage will in this way be less than if new cows are imported year by year.

A risk of contamination which is, I believe, kept too much out of sight, is that connected with neighbours or other persons (perhaps also animals) coming from infected byres and carrying the germs to a healthy one. I know at least several cases where a healthy farm seemed to have been infected in this way, and it does not seem at all improbable that we might now and then find the explanation for an otherwise incomprehensible outbreak in the soiling of the fodder by such intercourse.

The question of *Public measures* against epizootic abortion has been discussed in several countries, but as far as I know Norway is the only country where abortion is a scheduled disease. According to a Royal resolution of June 22nd, 1903, infectious abortion is scheduled under the so-called "milder contagious diseases" (law of the 14th of July, 1894, § 14). The owner is obliged to report when such a disease is found in his

herd, and he is not allowed to bring animals that he thinks seized with such a disease to fairs or cattle shows, to a foreign byre or field, or to sell it otherwise than for slaughter. But as a cow that has the abortion inflammation in the womb does not show any symptoms at all of a disease until a few days before the abortion, it does not seem likely that these regulations will diminish the spreading of the disease greatly. They are, nevertheless of some value, inasmuch as they may serve to call attention publicly to the fact that abortion is an infectious disease, and that it is unfair to sell an aborting cow to a man who does not suspect that the animal may perhaps introduce into his herd a most disastrous disease.

It is, of course, a very difficult task to legislate on abortion, because the disease is so common that it is difficult to maintain draconic measures against it. The want of symptoms until a short time before the abortion and the fact that not every case depends upon infection, will in many cases seem to excuse the seller.

Notwithstanding the difficulties, I think it necessary that the State interfere in order to protect the farmer against the heavy losses which may follow the introduction of abortion into his herd. It should not be permissible to sell cows or bulls from an infected herd without indicating the existence of the disease, nor should such animals be admitted to common grazing. From Norway, where common grazing in the mountains is in many places the rule, Mr. Isaachsen cites many observations of the spreading of the disease in this way. He also mentions the great risk connected with the unfair traffic in diseased animals—farmers who have struggled ineffectually against epizootic abortion auction their herd and thus spread the disease to many unconscious fellow-men.

It is highly probable that the diverging customs will require diverging laws or regulations in different countries, and I shall not try to discuss these questions in detail. One thing is sure, that besides, or perhaps before such regulations, much work must be done to enlighten the farmers on the true nature of the disease and on the ways in which it is propagated. Without this the best laws will not give the results that could else be expected.

Immunisation Experiments.

The fact that abortion inflammation has a natural tendency to die out in a cow after several abortions leads us to believe that the aborting cow acquires a certain *immunity*. The degree of immunity is not a constant one, as some cows, luckily very few, continue to abort five times, and although most cows only

abort two and three following years, it sometimes happens that they abort again after one, two or more normal parturitions. Notwithstanding this fact, which seems to prove that not every cow possesses the same power of producing antitoxic or antibacterial substances, it seemed to me to be a useful task to try to find out *whether it was possible or not to confer immunity against abortion by means of introducing the specific bacillus or its products into the body of the animal before pregnancy.*

During the last three years we have made several experiments with cows and with sheep and goats. The first two years we tried to immunise by means of *intravenous injections of living bacilli* (pure culture in serum-bouillon) some time before copulation, and when the animal was pregnant we infected it either by feeding it with culture, or with parts of an aborted afterbirth, or by intravenous injection of culture. As might be expected, it is much easier to protect against infection by feeding than against infection by intravenous injection. Out of 8 sheep which had injections into the jugular vein several times in the course of a year (6, 6 times, 2, 3 times) with a serum-bouillon culture; 4 were fed with abortion bacilli, about 70 c.c., 4 injected intravenously 10 c.c. The first all bore their lambs to full term, the latter all aborted. As infection under natural circumstances must correspond more to a feeding experiment than to an intravenous injection we limited ourselves in the future to the first way of infection in order to control the degree of immunity we had conferred.

In the year 1903-1904 *four heifers and one cow* were injected once (1) or twice (4) into the jugular vein with 10 c.c. of a serum-bouillon-culture. Having conceived, they were fed, four with culture (70 c.c.) and one with exudate. Three carried their calves to full term, but two aborted. One not vaccinated heifer aborted $3\frac{1}{2}$ months after feeding.

This result does not seem to be good, but on closer examination we find that the two vaccinated animals that aborted, received the intravenous injection a rather short time before the copulation—16 and 26 days before—whereas the three resisting animals were injected 66, 67 and 196 days before. It seems, then, rather probable that bacilli injected into the blood some weeks before copulation may remain alive in the body and be able to grow in the uterus if the cow conceives. On some farms where I tried vaccination by intravenous injection of bacilli I found similar results.

An experiment with goats gave the result that two not vaccinated aborted two and $3\frac{1}{4}$ months after eating 20 cc. of culture, whereas of five goats, vaccinated intravenously twice with 10 cc. of culture, *three carried their kids to full term* and *two aborted.*

They were all fed either with culture (20 c.c.) or with exudate. The two aborting were both vaccinated a rather short time—11 and 20 days—before the copulation, the others were served a little later.

By the experiments with intravenous vaccination of cows we made the curious observation that while they never showed any pathological symptoms immediately after the first injection (that they got some fever later I have mentioned before) a second, and especially a third injection, as a rule produced very marked symptoms of disease. After the second injection they turned dizzy and breathed frequently, and sometimes they fell down for a moment. After a third injection * they suddenly fell down immediately after the canula had been taken out of the vein, respiration was very frequent (90 times to a minute) and they looked so weak that we feared they would die. After some minutes they got up again, would not eat immediately, but soon recovered.

Although there does not seem to be any real danger connected with these peculiar accesses, they evidently make the intravenous injection a very unpractical sort of vaccination if it is to be used more than once or twice, and the fact that an injection into the vein one month before copulation involved a certain danger of producing abortion instead of vaccinating against it, also made it very desirable to find better methods. We therefore made several experiments on the effect of *subcutaneous injection* of cultures containing living bacilli and of such cultures in which the bacilli were killed by means of toluol.

In the year 1904-1905 we made several experiments with sheep and goats. Some of them gave no satisfactory result because the exudate that we used in order to produce abortion by feeding seemed to be non-virulent, as the control animals did not abort nor did those vaccinated. In other series where we used cultures for infection the control animals aborted, while the vaccinated animals—9 sheep and 7 goats—carried their lambs and kids to full term. Of the sheep two were vaccinated intravenously and four subcutaneously with living cultures, three with cultures, in which the bacilli were killed by means of toluol. For the goats the corresponding figures were 2 3 and 2. In almost all cases the injections were repeated several times, and the total quantity given to each animal was about 30-40 c.c. These experiments then seemed to prove that the immunising power of the culture was the same when the bacilli were introduced under the skin as when they were injected into the blood, and even if the bacilli were killed by

* The observations here mentioned belong to an experiment, made in 1903, which gave no result, because the cows would not conceive.

means of toluol. Further experiments made in the *last year*, however, proved this not to be the case.

Fifteen goats and two sheep vaccinated by means of subcutaneous injection of living culture (50-70 c.c. as the average to each animal, divided in 5-7 doses) carried their kids and lambs to full term, although about $2\frac{1}{2}$ months after conception they were fed with a great quantity (about 40 c.c.) of exudate from an aborting cow, a feeding which produced abortion in four not vaccinated control goats. Quite different was the result of the vaccination by means of subcutaneous injection of a corresponding quantity of culture in which the bacilli were killed by means of toluol. Of ten goats vaccinated in this way and fed as the others seven aborted, and only three carried their kids to full term, and of two sheep treated in this manner one aborted and one carried to full term. Thus it seems evident that cultures in which the bacilli are killed have not at all the same immunising power as living cultures.

As to the *duration* of the immunity we had opportunity to make the following observation: In 1903 five old goats, and four of them again in 1904 were treated with intravenous injection of living culture, and both times carried their kids to full term, although they were fed with virulent matter. In 1905 we did not vaccinate them, but in January 1906 we fed them in the same manner as the other goats. They all carried their kids to full term. This was also the case with the goat that had not been vaccinated since 1903. Immunity acquired by living bacilli thus seems to last a long time.

The main experiment of last year—that with cattle, is not quite finished yet, but I shall here give a preliminary report.

On five heifers we injected subcutaneously in eleven doses a total quantity of about 180 c.c. of culture, in which the bacilli were killed by means of toluol. Some months after the conception we fed them with a rather large quantity of infecting matter (about 200 c.c. of exudate and fœtal cotyledons.) *Three* of them aborted after $2\frac{1}{2}$-3 months, but *two* carried their calf to full term.

Four heifers were injected subcutaneously *with living culture* (at the average 140 c.c., given in ten increasing doses, beginning with 4 c.c. and ending with 40 c.c.) Three of them have not as yet aborted, although, exactly as the others, they have been fed with infecting matter three or five months ago.

Only one has aborted, which happened a little more than four months after the feeding, but it deserves to be noticed that in this heifer the injections as a rule produced abscesses, and it does not seem improbable that this may have been the cause of the bad result.

Of four not vaccinated *control-heifers* one has not yet aborted, but three aborted 2-3 months after the feeding.

It will be seen that subcutaneous injection of culture, in which the bacilli are killed has not been able to produce immunity against a strong feeding infection, neither in cattle nor in sheep or goats. In some animals the result has been good, in others not. *Subcutaneous injection of culture containing living bacilli has protected all my goats and sheep.* As to the cattle I have the hope that most animals will resist, but one heifer, in which the injection produced abscesses, has aborted.

I am far from pretending that I have solved the question of vaccination against abortion, but I think that my experiments have made it probable that it will be possible in this way to get efficient results, and I hope to be able to continue the experiments, perhaps in a somewhat modified form. Whether in future *vaccination* will be the chief weapon against contagious abortion or not, time will show. At present it must be our task to teach the farmers that they can do very much against this disastrous disease by *isolation and disinfection.* The main thing is that they be made thoroughly to understand the nature of the disease and the many ways in which it spreads.

Discussion.

Prof. A. E. Mettam, in opening the discussion said:—I need scarcely say that I feel this is the greatest honour of my life, in being asked to open a discussion on a paper written by Prof. Bang. I have had the great honour of Prof. Bang's acquaintance, and I hope his friendship, for some time; but when I was asked to undertake the duty of opening the discussion on a paper by my master (I hope he will accept that expression in its fullest manner, because I look upon Prof. Bang as one of the masters of the veterinary profession (Cheers). I need not say that my heart was filled with joy as much as I was troubled in my mind as to whether I would be able to do justice to the paper. Prof. Bang has a world wide reputation, and in no part of the universe is his name revered and are his opinions accepted with so great enthusiasm as in the United Kingdom of Great Britain and Ireland (Cheers). We all know the work that Prof. Bang has done; we know how his suggestions for the prevention of tuberculosis would, if they could be carried into effect, yearly save thousands of pounds to the owners of stock, and not only indirectly but directly prevent considerable loss of human life; in fact the work he has done with regard to tuberculosis is sufficient to give him a high place in the niche of fame. When we come to consider the work that Prof. Bang has done, more particularly in recect years, on contagious abortion, all I can say is that we must confess ourselves as highly blessed in having Prof. Bang as a member of our profession and associated with the teaching of

veterinary science. I have been more or less familiar with Prof. Bang's work on abortion since it has been published, and it struck me at the time that he had traced the cause and indicated the methods of prevention ; and we then looked forward to the time when he would tell us how this dire disease of contagious abortion could be eradicated from our herds and flocks. I am one of those who believe that contagious abortion, so far as monetary loss is concerned, is second, if it is second, to tuberculosis alone, because no one knows what is the actual loss accruing from an outbreak of contagious abortion. A farmer might estimate what he considers to be the actual loss, but to my mind the potential loss is that which is the most appalling. The organism of contagions abortion as Prof. Bang has indicated for some years past, is a very peculiar organism ; it is very small and requires looking for very carefully. It is a peculiar organism as regards its culturable and morphological characteristics, but the genius of Bang and the genius of Stribolt, working under Bang, to a certain extent removed that difficulty, because he showed how we can obtain the organism in pure cultures if we subject it to peculiar conditions. Those conditions he indicated with the lucidity that we expect from Bang, who, needless to say, speaks my own language as well as I speak it myself. He will be able to tell us afterwards how he proceeded to isolate this organism, to get it into a pure culture, and I hope he will be able to tell us how he has used the various preparations which he has made from the living bacteria to safeguard animals against this dire disease. Prof. Bang in his paper indicates the methods by which the disease is spread. I am very pleased, for my part, to see the position in which he puts the act of coition as a means of spreading of the disease. I have maintained for some time that copulation is a very common method by which the disease is spread and conveyed not only from one herd to another but also how it is spread through the herd. The organism is undoubtedly conveyed by the male organ of generation, by the penis, to animals that are otherwise perfectly sound, and the probability is, as Prof. Bang has pointed out, that animals which have enjoyed a reputation for good health and for good stock-getting properties become ruined as the result of a dirty cow being brought to these particular bulls for service. I think there are many of us here who could give chapter and verse for a large number of outbreaks of contagious abortion which could be traced directly to the influence of the bull. The history, as most of us know, is something like this. A cow comes to be served : possibly it may be a neighbourly act on the part of the owner of the bull to allow his neighbour's cow to be served. It may be that that particular bull is of fancy blood and that some person in a neighbouring township would like to have a calf by that particular bull. The cow which the bull serves has probably recently aborted, or at any rate she has, as we say in this country, broken service, and has " come round again " as the common term

is. It is considered merely as an accident in a large number of localities ; if you speak to the intelligent agriculturist he will tell you that he looks upon it as an accident, that "she has missed." As the result of the connection between that cow and the bull, that bull becomes infected and spreads the disease among the cows of its owner. So the trouble goes on, and sooner or later the cattle that have been served by this bull that has been soiled by the first cow commence to abort. And, as I said at the commencement, no one can estimate the potential loss to that farmer, his calves being lost and his trade more or less ruined, more particularly if he happens to be a dairy farmer. Take, for instance, the South of Ireland. In the South of Ireland the conditions are somewhat remarkable as compared with what they are in England. It is the custom in Ireland, at any rate in the Southern districts of Ireland, for all the cows to bring forth their calves practically within a period of six weeks. From about the middle of March to the end of May the vast majority, I think I may say 90 per cent., of the calves are born. Supposing it happens that the cows slip their calves beforehand, then the cows are not in milk at the time the farmer has estimated that they should be, and consequently not only the direct loss of the calves but the loss of the milk and the missing of the market is a point which cannot be too strongly emphasised.

Then the next point, and one which I think is of the greatest possible importance, is the fact that Prof. Bang has shown from his experiments that contagious abortion may infect an animal by ingestion. I think that is probably one of the greatest proofs of the spread of contagious abortion that we have had for many years, and it applies not only to contagious abortion but to other diseases. We are more or less familiar with the way in which these diseases are spread, but it was a mere supposition, a mere imagination, on the part of some people that possibly ingestion was a means of spreading contagious abortion. But Prof. Bang has proved it, and having proved it, he indicates certain lines that we must follow in order to prevent the spread of contagious abortion. He has proved it in a way that commends itself to all of us as practical men, because what is more common than that the cow, having aborted, and leaving her placenta or the fœtal envelope, and her dead calf on the field, other cows in the field will come and not only take the grass that has been soiled by the discharges, but also, it is more than likely, may partake of the cleansings which have dropped from the cow that has aborted. Every veterinary surgeon is familiar with the morbid appetite of the cows, how they will eat all sorts and conditions of things ; and it is not beyond the bounds of probability or possibility that cattle may consume the abortions of a diseased cow, and thereby be a means of spreading the disease through the herd. I think that one of the greatest proofs of infection is the demonstration of the fact that contagious abortion may be conveyed by direct ingestion. I pass over the experimental work of injecting the

organism into the blood system, because, as Prof. Bang indicates in his paper, that is an experimental method of infection alone ; it is not likely it will be a condition which will occur in Nature. But there is one very important paragraph on page 25 where he mentions that he injected into the jugular vein of a mare a bouillon-serum culture of the organism and that he set up contagious abortion in the mare. I am of opinion that contagious abortion in mares is a much more common accident than the profession at the present moment believes. I have plenty of evidence to satisfy me that there are a large number of mares, mares of the highest quality of blood, that are barren, as the horseman terms it, year after year, and that they are suffering from neither more nor less than contagious abortion. Comparatively recently I was consulted by a member of the profession who has a large practice among breeding stock, and he had a large number of mares that had slipped their foals, that is to say, the foal was born before its time, in a weakly condition, and sooner or later died. The mare had a discharge, not to a very great extent, which was more or less persistent. She was put to the horse time after time at a big fee, and she did not conceive. He asked me to look into the matter for him, and I offered him all the assistance I could give him. We made a careful examination with a speculum, examined the condition of the os and the condition of the secretions. The os was of a more or less violet colour, swollen, gelatinous looking, and escaping from it were drops of what looked to be like muco-pus. I made an extensive series of microscopical examinations, and I thought I saw there the organisms which Prof. Bang described 10 years ago. I was not quite certain of it, but I saw there what I took to be these organisms. I convinced myself that these animals were suffering from some disease which, if we saw it in a cow, we should call contagious abortion, and I suggested the application of the methods that Prof. Bang has recommended in his work, namely, that the uterus should be thoroughly disinfected, that the disinfection should be carried out, as it ought to be carried out, very thoroughly and conscientiously, and that after a length of time, when the discharge had ceased, these animals might then be put to the stud. Those suggestions were carried out, and I believe the animals are now pregnant. At any rate, I think the members of the profession cannot keep too fully before their minds the point that Prof. Bang has pointed out, that contagious abortion is not merely a disease of cattle, but that it is likely also to infect our studs. Prof. Bang also mentions that, in his opinion, the organism of contagious abortion is a purely pathogenic bacteria. I would like to ask him how long he thinks that this organism of contagious abortion can live in the discharges from animals that have aborted. How long may the discharges remain infective after they have left the body ? How long the placenta may be infective ? What is the effect of sun and of air upon the bacteria ? Does the bacterium live

outside the body, say, on the grass of the field for days, or a week, or weeks ? Is it possible that a certain patch of ground which has received the discharges of an animal that has aborted may be infected for a period of time, say, three weeks, or does this bacterium disappear more or less rapidly owing to the effect of sunlight and other causes ? Then Prof. Bang proceeds to mention the treatment, and he emphasises again the points which he made in his article of 1897, that the virus is in the exudæ. Destroy the exudæ, and you destroy the virus and check the disease. Practically that epitomises what Prof. Bang tells us with regard to the treatment. But there is one point I would like to ask him, and that is, Has he tried carbolic acid in the food ? I must confess that I have not much faith in the giving of carbolic acid in the food ; I could not exactly see how it was going to act. I know that carbolised water or an injection of a dilute solution of carbolic acid under the skin, has been recommended, but it was pointed out by certain physiological chemists that carbolic acid, when it was injected under the skin, became converted into a product more or less inert and unsatisfactory, But now we know that Prof. Bang has produced the disease by given contaminated material, infective matter, in cultures by the mouth, we can possibly see the value of carbolic acid put into the food, because it is probable that at some time or other the organisms of abortion and the carbolic acid may meet in the stomach, and that the carbolic acid may effectually disinfect the food of, at any rate, the organism of contagious abortion. I would like Prof. Bang to kindly tell us what his experience is of carbolic acid, and whether carbolic acid is given in the food in Denmark as a treatment for contagious abortion.

The next point that I come to is that of prevention. In this connection I have not much to say, because I believe I am correct in saying that the whole question is *sub judice*. Probably one is rather rash in discussing this question of contagious abortion when a Royal Commission is sitting to investigate the disease. I know nothing as to the experiments, or the results of the experiments, of the Royal Commission, but if I may venture to prophecy I should say that probably Prof. Bang has anticipated the findings of that Commission. (Hear, hear). I think that under the head of " Prevention," we find really what I may term the gist of the subject of the eradication of this disease. Prof. Bang mentions the separation of the infected animal from the remainder of the members of the herd that are still healthy. That, of course, is most essential. It goes without saying that, if we are to stop the progress of a disease, we must remove those animals which are the means and the cause of the spread of the disease. We must stop, as it were, the fonts of the disease ; we must quench it. Prof. Bang proceeds to say— " The question of public measures against epizootic abortion has been discussed in several countries, but as far as I know Norway is the only country where abortion is a scheduled disease. According

to a Royal resolution of June 22nd, 1903, infectious abortion is scheduled under the so-called 'milder contagious disease' (law of the 14th of July, 1894, 14). The owner is obliged to report when such a disease is found in his herd, and he is not allowed to bring an animal that he thinks is seized with such a disease to fairs or cattle shows, to a foreign byre or field, or to sell it otherwise than for slaughter." Would that that law was in force in some parts of the United Kingdom! (Hear, hear). I believe that that is the means by which the disease is spread from townland to townland, from parish to parish, from county to county, and I am afraid the members of the veterinary profession are not quite free from blame in this matter. I do not want to give the profession away, but in how many cases is it suggested that an animal should be got rid of?

Mr. TRIGGER: Very few.

Prof. METTAM: I hope so. What I want to point out is this—that it applies not only to the United Kingdom, because Prof. Bang in his paper mentions that in Mr. Poulsen's case, seven cows aborted. Six he treated successfully, but in one case it was unsuccessful; it became unthrifty, and was got rid of. In how many cases are these unthrifty ones got rid of? (A Voice: Slaughtered). I hope so. I would like to see all these cases taken in hand and slaughtered, or effectually treated, by the veterinarian in attendance; and these animals which are the means of spreading the disease should be disposed of in such a way that there is not any likelihood of them being the means of conveying the disease to healthy herds. I think what we have to do, as members of a profession closely associated with agriculture, is to educate the agriculturist up to the point of recognising that this disease is a most serious infection, and that it behoves him to take the matter in hand himself, for his own protection and for the protection of those round about him. If he carries that out, he will himself benefit, not only indirectly but directly, from those simple precautions.

I have very little to say with regard to the immunising experiments. It is very interesting to observe that Prof. Bang recommends that a pure culture of the organism should be used, and that it should be injected subcutaneously some time before the animal is sent to the stud. I would like to ask him if he thinks it would be possible to create this immunity in young animals—if it would be possible, say, before breeding time arrived, that is to say before they were 18 months old, to give these animals a lasting immunity to contagious abortion by the injection of these living cultures. Of course, this operation I presume would only be done by members of the profession. (Hear, near). One of the drawbacks of the production of vaccines and anti-toxins is that they get into the hands of the layman. Speaking in this connection as a mere aside, I would like to see some measures taken whereby these more or less potent means of combating disease were placed in the hands of the profession and the profession alone. (Cheers). I am sure Prof.

Bang will agree with me that one of the drawbacks of this method of immunisation is the fact that you are using living bacteria, bacteria which is able to set up the disease, and that is the drawback of any material used in immunising experiments. I think wherever a material is produced containing a living bacteria, which is capable of setting up the disease when used under certain conditions, that that material should be used by the professional man, and by the professional man alone. (Hear, hear).

Gentlemen, I have finished. I would have liked my remarks to have been very much more to the point, because I am afraid they have been rather straggling, but I have had very little time to prepare anything in the shape of an opening address. But I wish again to say, as I said at the commencement, how highly honoured I feel in being called upon to open the discussion on this paper, and how heartily and thoroughly we welcome Prof. Bang in our midst. (Cheers).

Mr. James McGavin: I think I voice the views of all the members of this Association in saying that we are greatly indebted to Prof. Bang for his very able paper, the discussion on which has been opened by Prof. Mettam in such an interesting speech. I believe this is the first paper we have ever had at the Association from a Continental veterinary surgeon. That augurs well for the future, and I hope that not only Prof. Bang but other Continental veterinary surgeons will come over occasionally and assist us in our deliberations. (Cheers). Prof. Bang in his paper mentions that the principal sources of the reception of the infection of contagious abortion into the system are copulation and ingestion by soiled food. They undoubtedly spread the disease to a great extent, but I think where animals drink foul water, especially pond water, that has a very great action in spreading the disease. We all know very well what a farmyard is, especially a small one; there is usually a stagnant pool where most of the animals go and drink. A cow aborts, the microbes find their way into the pool, and there they remain. I look upon a pool of such a kind as a source by means of which this disease is spread. Another source of receiving the bacilli into the system and spreading the contagion is *womb intoxication*. But whatever way the infection comes in, once we have specific abortion in a stock it is hard to get rid of it. I am no believer in drenching the animals with drugs. I hold that drugs do no good, at least in the stomach, with contagious abortion. Carbolic acid received a trial by a great number of people, but it was a failure, and other things have been tried in the same way. The best means of treating the disease, in my opinion, is to isolate the animals that are infected. They should be taken out of the herd and placed by themselves in a box. But the great difficulty is this. Where can you get such a box? You are short of buildings; every place is full up. If you wish to stop the disease, it must be done by disinfection, and that you must do thoroughly or there is no use doing it at all. As I

said before, one of the best means of checking the disease is to isolate the animal in a box, say, 16-ft. feet square, or any size you like, divided into two compartments, where you can tie up two animals and treat them with irrigation. You mix up whatever antiseptic you like to use and inject it, or do it by irrigation with an india-rubber tube and a funnel, placing the pipe into the womb, and washing the animal out two or three times a day. Prof. Bang has suggested that the placental membranes should be removed as soon as possible, if possible the first day. My experience of these cases is that it is very difficult to remove those membranes. I do not know what Danish cows are, but I know that in Hereford it is very difficult in many cases to remove the membranes of an animal that has aborted. The plan I adopt is to irrigate the membranes, and to take them away, say, two days afterwards, and they then come away much quicker. There is one question I should like to ask Prof. Bang, namely, is contagious abortion in cows the same disease as contagious abortion in mares? In other words, is it due to the same bacillus? If you have contagious abortion taking place in mares, do you find the cows aborting at the same place; or if you have contagious abortion in cows, do you find that the mares abort? My experience on that point is that it is not so, and we have had a good deal of experience of it in my district. Where you get the mares aborting you do not get the cows aborting, and where you get the cows aborting you do not get the mares aborting.

Mr. Walter J. Fletcher (Wrexham): It is my fortune to live in a district where there is a good deal of abortion. In that district a great effort has been made by the farmers to protect their herds against the disease by the use of carbolic acid. They have adopted the treatment very thoroughly, because the have administered carbolic acid in the food, they have purchased the best enema syringes, and have used antiseptics in thevagina, but, unfortunately, up to the present without any signs of success. The last speaker mentioned the question of whether mares aborted at the same time as cows. We have not found that. Another thing I have noticed is this: the disease has been going on for some years now, and I have noticed that the abortion takes place at a much later period. Sometimes it does not cause that amount of loss which it used to do, because we find cows coming into milk and we get a good source of profit from them. That is one comfort. It may be that they are becoming immune by the fact of the disease having been amongst the cattle for so long. In speaking about the use of disinfectants for washing out the uterus, and that kind of thing, Prof. Bang did not mention the length of time the bacillus is found in the uterus after the cow has aborted. If it is in the uterus for some time, it is almost impossible for a farmer, I consider, to find any means of washing the uterus out. He will wash the vagina out, but he will not find anything there. Therefore it becomes a very difficult question to know how, if it is in the uterus, you can

possibly get rid of it from that position With regard to the question of isolation, if a farmer isolates his first, second, or third case, and then finds that the cows abort again, it is no good talking to him any further about isolation, because he is a disappointed man. In addition to that, you must remember it is quite impossible to find any means of properly isolating animals where you have an outbreak on a large farm. I hope Prof. Bang and other scientists will be able very shortly to give us some further information about this disease, and hold out some hope that it may be stamped out. It is so serious a matter that I think it is time the Board of Agriculture undertook some arrangements by means of which aborting cattle could not be sent into the markets. It has given me very great pleasure to read this paper. I looked forward to perhaps gaining more information than is contained in it, but evidently the problem will take some time to unravel. We sincerely hope that the present Commission which is sitting will give us some valuable information. I expect that most of the members present have received the form which has been sent round by the Commission, giving all the advice they possibly can, and from those papers we may derive a great benefit.

Mr. R. Rutherford: I have nothing but the greatest admiration for Prof. Bang's paper, and also for the masterly way in which Prof. Mettam opened the discussion. I am afraid, however, speaking as an old practitioner and one with very few opportunities of judging on the subject, that to a large extent the profession will remain unsatisfied on one or two points. Those points I desire to bring before this meeting, in the hope that some of those who are more scientific than myself will be able to give us a definite answer one way or other. One reason why I mention these points is this, that every now and again one is astonished, in reading the reports of the proceedings in the Law Courts in this country and in Scotland, at the absolutely diametrically opposite opinions that are given by the best men in the profession. The subject of my remarks was given to me by the gentleman who has just spoken when he referred to epizootic abortion. I want to ask whether it is anything but epizootic, and if it is not anything else than epizootic how it arises. Is there anything in the contention that abortion can occur from accidental causes? For instance, my friend mentioned the case of animals drinking dirty water, and in the course of some evidence which a Professor gave in Glasgow the other day he said the disease arose from nothing else but dirty drain water, that it had its origin in that water and nothing else. I should like to ask this question of Prof. Bang: Is it within the bounds of human possibility that a case of abortion accidentally occurring, if it does occur accidentally, can afterwards develop into an epizootic form? Is it possible for the disease to grow from an accidental cause, or is it not? I think it would be satisfactory to the great majority of the profession if a fairly strong opinion was given on that one point.

For myself I have travelled from Edinburgh to hear the point raised if possible, because only the other day I was consulted in a very bad outbreak, where the contention was that it was produced by abortion and nothing else, whereas as a matter of fact the contention of the other side was that the exciting cause was a squadron of cavalry galloping through a field where some in calf animals were, where they had never had abortion before, and where they had the greatest difficulty, once it started, in stamping it out. The point is, therefore, is there such a thing as accidental abortion, and is there such a thing as the possibility of that accidental abortion becoming capable of producing the specific disease? I have a strong opinion that the point is worth raising, because from my experience I think nearly every disease of the mucous membrane accompanied by a discharge is capable of becoming infective.

Mr. CAMERON: I think, in the first place, our thanks are due to the Council for having selected this subject for consideration. Instead of the discussion on the subject being indefinitely postponed, I think it was high time the profession took the matter in hand and gave it a representative discussion. A body such as this should take the lead in an important subject. I feel greatly indebted to Prof. Bang for the able manner in which he has dealt with the subject. There is one point to which I should like to refer, on page 30, Prof. Bang refers to farmers getting rid of the disease by selling the aborting cows and buying new ones. Prof. Bang has put that in the past tense, but as far as this country is concerned it should be put in the present tense. That is one of the great means whereby this disease is spread, more especially between Michaelmas and Christmas. At that time milk is scarce, and cows are dear to keep, with the result that the farmers sell this stock to the dealers, and the disease is spread wholesale. I remember, a good many years ago, a cow aborted at a certain period of gestation on one farm; another cow aborted on another farm, and about half-a-dozen different cows aborted on different farms at the same period of gestation, no abortion having ever being known to occur at those farms before. All those cows were served by the same bull on one particular farm. Such circumstances as those are brought to the notice of veterinary surgeons, and they are asked to give their opinion. It does not require deep scientific learning to give an opinion on such a case; the man in the street, or a hand on the farm can diagnose such a case as that, and knows that it must be of a contagious nature. With regard to the question of prevention, I wish to echo emphatically all that has been said with regard to the removal of the placenta and the washing out of the womb by the veterinary surgeon. I am not sure that the profession is altogether free from blame on that score. I admit it is a persistently stinking job; the smell is of the most offensive nature, and perhaps veterinary surgeons shirk their duty a little in that respect. But I say there is no duty which we are called upon to perform which we

should be more conscientious in, and I am happy to say I have a clear conscience in connection with it. There is a portion of the veterinary profession which I have observed is at sixes and sevens, and that is the veterinary editors of Agricultural periodicals. Some of these men give advice to farmers as to how to carry out this operation, others advise them to leave it alone altogether. Prof. Bang says at the end of his paper, "At present it must be our task to teach the farmers that they can do very much against this disastrous disease by isolation and disinfection." I think the teaching should devolve specially upon our Agricultural Societies; they hold their meetings regularly, and they could do their part of the work; but veterinary surgeons ought to help in the education of the public, and personally I should have no objection to distributing the Board of Agriculture leaflets on the subject.

Mr. R. C. Trigger: I am sure everyone has read this excellent paper with great pleasure and profit. I have never seen one which was more concise, or adapted itself better to the requirements of the country practitioner. Everything has already been said that can be said as to the great kindness of Prof. Bang in coming so far to educate us upon this important question, but I should like to add my quota of admiration in that regard. Can we wonder that contagious abortion has got such a hold in this country when we realise the conditions that have existed, certainly for the last twenty-five years? Within the last twenty-five years I have seen the aborted calves nailed on the end of the farm buildings as a preventive against abortion. Agriculturists now are sufficiently educated to know very much better than that, and to treat any such proceeding with the greatest contempt; but even up to the present day superstitions exist. Within the last year or two I could take you to farms where, for some occult reason, when a mare foals the placental membranes are hung on a whitethorn bush. (Laughter).

The one great lesson that I have learned to-day from Prof, Bang's paper, which had not occurred to me previously, is the fact that contagious abortion may be spread by ingestion, with the food. In all my efforts to stamp out and prevent contagious abortion, I do not think that had occurred to me. It is certainly a great lesson, and one well worth bearing in mind.

Mr. Rutherford has asked whether abortion can occur otherwise than in the form of contagious abortion. I think a question which will occur to us is this, what is the effect of a pack of hounds when it goes through a flock of sheep? You certainly nearly always get a very bad outbreak of abortion within a few hours. I have seen such cases happen the same night. I remember as a boy, long before I was in the profession, a heifer seeing an aborted calf in a yard, and within a day or two that heifer aborted. I remember that making a great impression upon my mind at the time. In that case it might have been contagious abortion, but the probability is that it arose from nervous or mental impression. I think there can

be no doubt that we can get abortion independently of contagion. There is another point that occurs to me in connection with abortion amongst mares. A mare with twin foals practically never—I do not say absolutely never—carries those twin foals to the full period of gestation, but she aborts in the paddock or amongst other mares. I always treat that as a case of contagious abortion, but I never knew it spread from a mare aborting twin foals. There is one point that will guide us very much in coming to a decision. I think the lines which Prof. Bang has indicated he is working upon in his endeavour to obtain immunity are the lines which must govern the veterinary profession, because if we get abortion from obscure and unsuspected causes, such as a tainted bull, quite innocently spreading contagious abortion without the agriculturist really being guilty of any negligence, we must realise that our efforts must be directed to obtaining immunity, and I hope Prof. Bang is a long way on the path in that direction.

There is one paragraph in his paper which struck me as very important as showing how very difficult it must be to know when harm may actually occur. On page 30 he says:—"A circumstance not to be forgotten is that a cow that has calved at full term may nevertheless sometimes furnish a vaginal discharge that is infective. Abortion often occurs very late in the pregnancy, so it is easy to understand that sometimes the cow may carry her calf to full term although the specific inflammation exists in the womb. That this happens is not only observed by trustworthy observers, it also happened in some of my experiments. It may perhaps be assumed that in such cases the bacilli are less virulent than usual." Where a cow carries a calf the full term and practically aborts, or at all events parts with the calf, I do not see how we are to suspect disease in that case, and yet, according to Prof. Bang, we have a source of disease lurking in our midst.

In conclusion, I think I must take exception to the assertion of Prof. Mettam, that the veterinary profession were a little bit to blame in regard to this matter. Speaking for myself, I do think if there is one thing the veterinary profession have been impressing upon farmers for years past it is the contagious nature of abortion, and I really do not think a veterinary surgeon at the present time would suggest that an aborted cow should be sent into a market. My view is that the veterinary surgeon, if he were consulted, would point out the danger, because it is a danger that the youngest amongst us fully recognises. I thank you, gentlemen, for listening so patiently to me, and I desire to convey to Prof. Bang the very great pleasure and instruction I have derived from reading his paper. (Cheers).

Mr. R. Hughes: Professor Bang has placed the agricultural world under a deep obligation ever since he published the results of his investigations in 1897, and in this practical paper that he has presented to us I am sure he has placed us under a double feeling

of gratitude and obligation. I think it is about eighteen years ago since the late Professor Nocard carried out his experiments, confining his attention to the fact that this disease was entirely confined to the genital organs. Prof. Bang has identified the causal organism, and ever since his researches have been published, I am quite sure that our ideas as to the pathology and the etiology of this disease have been entirely revolutionised. To me, at any rate, they have opened a new field of thought, namely, how can this disease be combated?

Before proceeding to deal with that particular subject, it occurs to me that a question has been asked whether this disease is transmissible from one species to another. I have had a fair amount of experience and, like previous speakers, I should like to say that I have never known the disease to attack cows on the same farm at the time mares were affected; and *vice versa* when the cows were affected the mares were not aborting. That may be accounted for by the fact that the attendants attending the animals are not communicating one with the other. That is a question I should very respectfully ask Prof. Bang to give us some information upon.

The title of the paper is "Infectious Abortion in Cattle." Before going into the different modes of infection, I should like to ask whether any other cause can be suggested for the development of abortion. As Mr. Rutherford has said, there are accidental causes of abortion, or sporadic causes. I do not believe that such things as unsuitable food, like frozen turnips, succulent food with frost or extra dew in the morning, or sewage water, or mental impression, or foul smells can cause infectious abortion, otherwise the disease would be much more common, because all those suspected causes must first of all affect the general health of the animal. There must be in the first place a considerable amount of constitutional disturbance, and then, as a secondary event, abortion takes place. With regard to sheep, I have never known sheep abort where cows have been aborting on the farm, and perhaps that is due to the fact that they are not housed. But, even among farmers who have housed their sheep for Show purposes, I cannot cite an instance where infectious abortion has been conveyed from cows to the sheep. Fortunately abortion is not very common among sheep. Abortion in sheep, in my experience, has been obtained when dipping has been practised very late in the season, or where the sheep have been worried by dogs, especially over broken land. The difference in the latter cases is this, that the fœtus in the sheep is nearly always putrid, showing clearly that it has been dead for some time. That the infection is transferred directly by the genital organs Professor Bang has very clearly demonstrated. I think that we, as general practitioners, can emphasise this point. We must remember that the disease tends to die out, or the animals become immune. Wherever the records are kept of either cows or mares being regularly served, it is a common occurrence, in my practice at any rate, to hear the owners of the animals say "This

mare has broken her service." She aborts about the sixth, ninth or perhaps the twelfth week. In all probability she has been infected by the stallion. It is tolerably clear that she has aborted, has been served again, and proves in foal in the following year. What is the result? The mare aborts at the ninth or tenth month of the period of gestation, that is, she has aborted the second time. She does not abort the following year, especially if she is well attended to. I think under those circumstances that mare has become immune. She aborted at the early period of gestation, she aborted the second time, that is twice within twelve months. It is seldom, in my experience, that mares abort more than twice; it is rarely that they abort what I call a third time. They abort early in the season, again about the ninth or tenth month in the period of gestation, and then they go through.

On page 25 Prof. Bang says, "Nocard has already called attention to the possibility that the agents of infection sometimes might be taken in through the respiratory or digestive organs." Since Prof. Bang has established so clearly that an animal can be infected with this disease through the alimentary canal, I think this point is very important to establish. Most of us have had experience of the disease breaking out on farms rather widely apart, but it is difficult for us to discover whether there happened to be contact between one farm and the other. Prof. Bang states further on in the paper, that the food of the animals may be contaminated by contact with the boots, clothes and other things that the assistants wear. Of course the other means of infection are only likely to come before us in the experimental form, such as the intravenous injection or contamination. I will refer to that subject later on. The paper is replete with practical information, and brings every fact home to us as practitioners. Prof. Bang demonstrates clearly that the treatment must be of a preventive character. First of all, he tells us what to do with the animals, and emphasises isolation and disinfection—isolation as soon as the animals show the earliest signs of impending abortion, and then, as previous speakers have said, thorough disinfection of the animal. Prof. Bang also says that the after-birth should be removed within 24 hours. That is a point I have debated in my mind, especially in the case of a cotelydon placenta. If a cow aborts early, and there is retention of the placenta, there is a good deal of hæmorrhage. It is a point worthy of consideration whether the discharges are not likely to continue for a longer time than if we wait for the separation to become looser and riper for enucleation. I have no doubt Prof. Bang will refer to that point in his reply.

Then with regard to the bull, it is very clear that the sire conveys the infection. The custom I have adopted, which has been very successful, is this—and in this connection I desire to acknowledge my indebtedness to Prof. Bang's article of 1897. On a farm where there were from 50 to 80 cows, I advised my client to have two bulls, and only to allow his best bull to serve the cows that calved

at full time and were clean, and to keep the second bull for those that were suspicious, or, as Prof. Bang has said in his paper, cows that may come from other sources. By adopting the precautionary measures that he has so admirably set out in his paper, such as keeping the hair short and disinfecting the bull that is used for suspicious cattle, I think that is the most fruitful way of combating the disease.

Then the question might naturally be asked, "What will be the outcome of our preventive measures?" Our clients will ask us what we suggest, bearing in mind that the disease tends to die out. Is it wise for a man to sell his cows and get fresh ones? Professor Bang undoubtedly says "No," and I can fully endorse his remarks on the point. As long as a farmer sells his cows, and gets fresh soil for the virus of the disease to develop in, he will indefinitely prolong the disease on his premises. If cattle abort in the third, fourth or fifth month of the period of gestation I advise him to sell them to the butcher. If cows abort later on, in the seventh and eighth month, I can testify that it is worth the farmer's while to keep them. If he takes immediate means of disinfection and feeds liberally the milk alone will pay him, and he will have a cow that will carry a calf to the full term the next year, or at any rate the second year. By following out those preventive measures he will get rid of this troublesome disease, which is the cause of immense loss to pedigree stock breeders and owners.

There is one more point I should like to mention with regard to Prof. Bang's remarks about immunisation. I do not think that intravenous injection or hypodermic injection is likely to be favourably considered by agriculturists. What is the next best thing that can be done? The next best thing is to pay attention to the preventive measures, isolation and disinfection. My practice has been to remove the after-birth about the second or third day, for the reasons I have already given. I continue to irrigate the cow once or twice a day as long as there is a discharge, generally for seven or eight days, and never allow that beast to be served again until she is perfectly clean. If attention is paid to the bull, and those animals are slaughtered that are not likely to yield sufficient to pay for their keep, and attention is paid to the other points I have mentioned, I think we are likely to be more successful in eradicating this disease, and obtain better results for our clients.

Mr. P. Wilson: The paper which Prof. Bang has written is, in my opinion, of intense interest. Ever since he first described the causal organism I have studied what has been written on the subject, and I have come to the conclusion that, as far as our knowledge of infectious abortion is concerned, it begins and ends with Prof. Bang's discoveries: our absolute knowledge is based on those discoveries. With all our increased knowledge of the disease, in spite of the discovery that ingestion is also a source of infection, we still find that we are no further ahead as regards methods of pre-

vention. The rock-bottom principles of isolation and disinfection are still all that are offered to us, and I wish to say that if those principles are thoroughly carried out on the lines laid down by Prof. Bang, they can be relied on with a fair hope of success. We have heard that experiments have shown that animals may be infected by means of soiled pasture. I am very glad to know this, because it explains several obscure outbreaks that have occurred in my practice amongst heifers which have been served by young bulls, bulls that have never been in use before. It certainly behoves us to be more careful than we have been with regard to the pastures which are used by cattle or sheep, and also the fodder, which may be contaminated by the cows which have aborted. One of the means by which the infection is spread is undoubtedly the boots of the assistants. Most of us find it impossible to isolate animals in the way we would wish; we cannot get the necessary premises, and other considerations are in the way which prevent our carrying out proper isolation. We do know that the herdsmen walk about the cowsheds and come in contact with straw which is intended for the cows, and it is reasonable to suppose that the infection from their boots may contaminate the food or the litter which in course of time will come in contact with healthy cows.

There is one point that has not been raised as yet, and that is the question of the aborted calf as a source of infection. I wish to refer particularly to the live calf. The dead one we are all careful about, and most cow owners pay a great deal of attention to it, but the live aborted calf I am afraid often escapes the disinfection to which it is entitled. We know that the exudate covers the calf; it is found on the calf, and that calf is not properly disinfected. In the paper before us we have proof that the organisms are found in the intestines. What do we do in the case of a live aborted calf? If he does live—he does not live long as a rule—but while he does live I am afraid he does not receive the necessary attention. We ought, of course, to disinfect the skin, to disinfect the fæces, and to dispose of the bedding, just as we do in the case of the cow. I am firmly of the opinion that all cows and all calves should be disinfected, for a time at least, in infected herds, that is to say, cows which have gone their full time and calves which have been born at the normal period should be disinfected. I am afraid you will have some trouble in persuading owners to disinfect calves which have been calved at full time, but I have several times noticed a suspicious discharge, in fact a discharge of epizootic abortion, from cows which have gone their full time.

In connection with that I wish to cite a little instance. I have already said that we find the intestines swarming with the bacilli. In the early part of this year, in January, a number of calves, about seven or eight, were born in a herd of 40 cows. Out of those eight calves seven died: they only lived a few days. Each of the calves died as the result of a peculiar diarrhœa. When a post-mortem

examination was made it was found that inflammation of the membranes existed, but there is no doubt that diarrhœa was the cause of the death. I may say that this herd was badly infected with contagious abortion two years ago. I was called in, and every cow that had calved the first time aborted, the aborting period being from five to seven months. I was given a free hand in the matter, and although we had not another farm on which we could isolate these animals, the premises were large, and we were able to remove them some considerable distance from the other cows as soon as the symptoms were noticed. Prof. Bang's measures were adopted to the full. The placenta was not removed the same day, but was purposely left in order that it might be separated and more easily removed. Perhaps I studied my own convenience a little in that instance. But from the time the abortion took place the uterus was syringed out twice a day ; after the placenta was removed, it was syringed once a day for some days. The bull was the cause of the disease in this case. The measures were more successful than I expected, because we only had two cases last year, and of the eight cows which calved in January two only were eight months calves. Naturally they might be characterised as slips, but no case has occurred since, and I regard the herd as clean. In this herd I had several cows showing the yellowish, rather thin, slimy discharge which appears to be characteristic of contagious abortion. Not only was that discharge present, but the placenta in each case was was more or less thickened and jelly-like, and on attempting to remove it a peculiar watery, friable substance, which is also characteristic, due to the exudate under the chorion, was found.

Where there is a good deal of contagious abortion in a herd of cows which have calved the full time, I advocate that they should also receive attention, the womb at any rate being disinfected at least once. I am in rather a fortunate position with regard to this disease. I have a large herd in my charge, distributed over a large number of farms, and I have now practically a free hand in dealing with abortion. Two years ago I put into force Prof. Bang's measures, which were practised to a very modified extent before that time. Epizootic abortion has prevailed on the estate for quite a number of years, but the result of the adoption of the extreme measures has been very encouraging indeed. I do not intend to go into the measures which are being adopted; you already know what they are, but there are just one or two points I wish to emphasise. One farm on this estate is an isolation farm, and when we see a cow which is likely to abort we generally manage to get it away in time to this isolation farm. We have a number of boxes there kept for the especial purpose of these cases. As soon as they arrive they are put into the box, and as soon as the calf is slipped a disinfectant is at once used. Great care is taken with regard to the disposal of the placenta, the aborted calf, and the discharges. The bedding is also burnt for at least a week, and if there is any discharge the bed-

ding is burnt generally for three weeks. Before the bedding is removed from the box it is mixed with lime in the usual manner, and the abortion is generally buried. On this farm we only treat cows which have slipped. The discharges cease in about three weeks, although in some cases it is very much sooner, because they are not contagious cases at all, although we naturally treat them all alike. That is the only way, I consider, in which we can combat the disease.

There are undoubtedly cases of abortion due to accidental causes, but they are very few in number in my humble opinion. Most cases are infectious, and we are bound to treat them all alike; we cannot make fish of one and fowl of another if we intend to do any good. Some cows discharge very quickly. The disinfection is carried out by myself, and possibly each cow does not receive more than 3 or 4 injections altogether. The cowman syringes the vagina with an ordinary syringe, and that is continued until the discharge ceases A bull is kept solely for these cows, and is not allowed to serve other cows. The penis is sprayed before and after service, so that there is no chance of conveying infection. The cows are not served for at least three months after they have aborted, and sometimes an interval of four months is allowed to elapse. I am sure I am voicing the feelings of this meeting when I say we all hope that in the course of time the subcutaneous injection of living cultures will enable stockmen to protect their herds from this scourge, which is the cause of such a great loss to the owners of stock in this country (Applause).

Prof. J. R. McCall: I have read this very able paper with great profit and interest to myself. In this country, hitherto, it would appear as if we had not thought of the possibility of infection by the alimentary canal, and that is a point which is of the utmost importance. With regard to the question of the spread of infection by means of the penis of the bull, there was a very convincing case of that in Ireland some years ago in the herd of Lord ——. Professor Mettam may know the case. His Lordship had a herd on either side of a river. In one herd he had a very serious outbreak of contagious abortion one year, whereas on the other side of the river the herd was perfectly healthy. In the autumn he changed the bull from the one herd on one side of the river over to the other side of the river, and next year he had a very serious outbreak of contagious abortion in the hitherto healthy herd. That was one of the most conclusive cases I have ever come across.

The theory of infection by means of the alimentary canal opens up a very wide field indeed, and indicates the manner in which cases that hitherto have been obscure can be traced and understood. It also shows us how difficult it will be to treat this disease and guard against it, and I think from what Prof. Bang has written and from what we have heard to-day, probably the treatment of this disease in the future will rest either on the inoculation of the living

bacilli, in connection with which Prof. Mettam has said certain objections may arise, or, on the other hand, it will be remedied by means of an anti-toxic serum. From what we have heard on the subject I think that will be the practical outcome of this paper.

There is another point I should like to raise to-day, and that is that hitherto in this country it has been recognised there are two forms of abortion. There is contagious abortion, and there is another form of abortion which has been termed sporadic or accidental abortion ; and it has been thought that there are causes which give rise to this accidental abortion—I do not mean what we may term violent injury, but other causes. It has been thought that deleterious feeding materials, bad hygienic conditions, contamination and other causes which act detrimentally on the animal's system, may give rise to an anæmic condition of the animal, and as a result to abortion. That has been the theory held hitherto ; but lately it would appear as if there was one cause of abortion, and one cause only, namely, the presence of the specific organism. Perhaps this point hardly comes within the province of this paper, but I should like Prof. Bang to give an expression of opinion as to whether in Denmark they recognise that there may be causes of abortion such as I have mentioned, which will give rise to a number of deaths in the herd, and vhich may simulate contagious abortion.

I was pleased to hear that in Denmark or Sweden – I forget which —measures have been enforced by the Government to protect the public against the risk of infection by contagious abortion. I think myself that, bearing in mind the calamity which this disease is to the nation, some steps should be taken in this country such as those which have been adopted in Norway. It seems to me very hard lines that a farmer who purchases a cow may get an animal affected with the disease, and in that manner contaminate a large and hitherto healthy stock. I think, although there are great difficulties in the way of legislation, it would be a very good thing if we had some control over the difficulty in this country. In conclusion, I desire to thank Prof. Bang very much indeed for his most able and practical paper. (Applause.)

Prof. G. H. Wooldridge : I should like, first of all, to add my tribute of thanks to Prof. Bang for coming and giving us his experience in this way regarding the enormous work he has carried on in connection with abortion. In discussing the paper, the first thing that strikes me is the heading that has been given to it : " Infectious Abortion in Cattle." Abortion is generally understood as the name of the disease, but it seems to me that another name might advantageously be substituted for it. We have already been told, both by Prof. Bang and some of the other speakers this morning, that cattle carry calves the full period and yet become infected with this disease. I maintain, of course, that those cattle have not aborted. They may be affected with the specific disease which we call abortion, but which I think may be advantageously called some

other disease. Prof. Bang has shown that the main lesion in this disease refers to the womb. Would not it be just as well, therefore, if we spoke of it as specific metritis instead of abortion? Abortion is the main symptom of the disease, and I think we should avoid as far as possible calling a disease chiefly by the name of its chief symptom. The next thing I would like to refer to is a question which has been raised by previous speakers; I hope it will not be considered out of the scope of the discussion since the title of the paper is "Infectious Abortion in Cattle." The point is, is the disease the same in the various domesticated animals? I do not think there is much doubt that contagious abortion does exist amongst ewes, amongst mares, and amongst cattle. The question is, is it one and the same disease, or are they each subject to a form of abortion produced by a different cause? Many mares are sterile I am sure simply and solely as the result of this disease. If the disease is a metritis, it is easy enough to see that conception would be difficult or almost impossible in many of these cases. There, again, although the animal has never conceived, she is affected with the disease, and you could scarcely say she had aborted. If mares are affected with this disease, is it not possible that stallions also convey it from mare to mare in the same way that bulls are known to convey it from cow to cow? A question has been asked to-day whether, when abortion occurs amongst cows in a certain place, it occurs amongst mares at the same spot. I have only one experience of that particular phenomenon, namely, on the farm of my brother, where one year out of 30 cows between 20 and 25 aborted. The result was, of course, a very limited number of calves were reared that year and there was a considerable loss. But the interesting part of the case is that, in the same year, two shire brood mares on the same farm proved barren. The following year one of the mares carried a foal to the full time and the second one aborted; in the third year the mare which had carried the foal the full time went on breeding in the normal way, but unfortunately the other mare died in the spring time, so that we could not say what would have happened with regard to abortion in the third year. In that particular case, in that district all the cows were treated on the lines suggested by Prof. Bang in his original paper, with the result that there were no abortions whatever in the succeeding year amongst the cows. As I mentioned, in one year she aborted but nothing had been done to the mares at all, in fact it had not been suggested that it might be the same disease. The man who looked after the mares assisted in milking the cattle, so that it is quite easy to see how contagion may have been conveyed from the cattle to the mares.

Another thing I should like to ask is with regard to the transference of the disease by the bull. I do not think any of us doubt that a bull serving an infected cow may convey the organism to a healthy cow and set up the disease. But is it possible for a bull to be infected by ingestion, or by inoculation, and so produce the disease

in cattle? If it is possible, then again we have another point in favour of what I suggest. Here is a bull infected with a particular disease. A bull cannot be infected with abortion, but can he transmit it to the cattle? That is a point which is worthy of investigation, and I venture to ask if Prof. Bang has any experience on that line. The next point I desire to refer to is the treatment. I must disagree with one of the previous speakers, who suggested that he thought nothing new had been brought forward in this paper with regard to treatment. I think a very distinct step has been made when Prof. Bang shows us in his pen-ultimate paragraph that subcutaneous injection of cultures has proved quite effective in protecting his experimental sheep and goats. That is a very important point indeed, and although he says the experiments are not yet concluded, there is the greatest justification in regarding it as a probable means whereby the disease can be stamped out. With regard to the use of medicines by the mouth, some years ago I heard Mr. Laithwood discussing their effects, and he very strongly advocated the use of carbolic acid by the mouth. That point was mentioned to day, but the occasion I am referring to was of course before anything had been definitely shown with regard to the contagious nature of the disease or the causal organisms, but from his personal experience he recommended it as being efficacious in a large number of cases. If Mr. Laithwood is present perhaps he will give us some further information on that point. Some of the speakers to-day have said that they do not think any good result can come from treating the disease by the mouth. I do not think one is justified in coming to that conclusion. It is a specific disease, and if we can get good results by treating other specific diseases by drugs I do not see why we should not get specific results by treating this disease by drugs. I do not suggest it is infallible, or that any specific has been discovered. I must also echo the sentiment of some of the previous speakers when they say that notification ought to be enforced. I do not think any adequate attempt at the extinction of this disease will be instituted until compulsory notification has been established. That is the only way so far as I can see in which you will be able to stop the traffic in cattle that have aborted. Most of you know what some farmers are in connection with cattle that have aborted. It does not matter what the advice of their veterinary surgeon is, whether the advice is to get rid of the cow or keep her, the farmers will take their own course when the veterinary surgeons have turned their backs, and many of them run the cow off to the first fair or auction and get rid of it. I cannot think of any more immoral action in the way of trade than that—for a man to sell a cow which he knows, if introduced into a healthy herd, will cause injury and perhaps ruin to that second farmer, and all for the sake of a paltry pound or two in his own pocket (Applause).

Mr. W. H. Bloye: May I say, sir, that apart from the other great points which Prof. Bang has made in his paper, the making of

one alone has, in my opinion, justified all the trouble he has taken in coming here to England to give us the paper. The point is that it is possible to arrest the disease after the first abortion, in other words, that it is not necessary that abortion should continue for one or two further calvings after the one referred to. This in itself is a very great point. Of course, we need to emphasise the fact that vaginal injections alone are not sufficient, that it is necessary to carry the tube actually into the uterus, but the making of this point I consider is one of the greatest importance to us in endeavouring to stamp out this disease.

Mr. T. C. Fletcher: My principal reason for rising is the desire to have the honour of asking Prof. Bang a question in reference to the particular disease we have under discussion. Prof. Bang speaks in the paper of the disease being due to a bacillus. That, to him, is perhaps an easy matter of distinction, but to us veterinary surgeons who are in everyday business life it is not a matter that commends itself to us all, and if there is any possibility of his instructing us during the time we are here as to whether it is a difficult matter to detect the bacillus of infectious abortion, or that of accidental abortion, I think it would go a long way towards helping us to eradicate this particular disease. Several of the speakers have mentioned the fact that irrigation of the womb is one of the strongest courses of action we should take in the prevention of the disease, and one gentleman went to the extent of telling us that the womb ought to be irrigated two or three times a day—I think he said three times a day. Of course, it is possible to say that while we are sitting here, but where one has an enormous number of cattle to see, if one is sent for almost daily to come and remove a cleansing from a cow, I think it is the height of impossibility and foolishness to talk of the irrigation of a cow's womb two or three times a day. We all know that it is not a process that commends itself to any of us, and if we can possibly shirk the duty we do so. If we had to carry out this particular course of treatment it would mean that we should have to keep an army of assistants, and that no one wants to do. If you set an ordinary intelligent farm labourer to irrigate a cow's womb with a syringe, how far does he get it up? If he is careful he gets it up about six inches, and practically does no good at all, because it wants the guiding hand of a competent man to pass the irrigating instrument through the os to do either the slightest good or have any return for the trouble you have undertaken and the unpleasant smell you have experienced during the operation. Prof. Bang's paper is an excellent one, but I should distinctly like to hear whether there is any possibility of an ordinary everyday veterinary surgeon detecting the difference between the bacillus of contagious abortion and that of accidental abortion—in fact whether it can be detected.

Mr. H. G. Bowes: I should like to add a word of thanks to Prof. Bang for coming over here and giving us this excellent paper. I am sure that we ought to feel highly honoured that a gentleman of

Prof. Bang's scientific attainments should deem it worth his while to write such an important paper for our Association. To my mind the most important matter in the paper is the question of infection by ingestion. Up to the present we have considered that contagious abortion has been due to infection through the generative organs and the vagina, and it is most important to learn that the disease may be derived through the alimentary tract. That, I think, also explains the reason why we read so much of the carbolic acid treatment being successful in the prevention of contagious abortion. If infection is derived through the alimentary tract, there is no reason why the carbolic acid treatment should not actually prevent it. The next most important matter is the question of prevention by inoculation or vaccination. In regard to that matter the question that suggests itself to my mind is, " Does one attack of the disease give immunity for any length of time ? If it does not give any immunity against a subsequent attack, it is questionable whether any inoculation will be successful in the prevention of the disease. That is a point that time will tell. We hope that Prof. Bang will continue his work in this matter and invent a protective serum or vaccine which will, I am sure, be of very great service to the agricultural world generally. (Adjourned for lunch.)

Mr. J. S. Lloyd: It is not my intention to detain you for long, but there are a few headings in the paper to which I would like to refer. The first is accidental or sporadic abortion. I do not think for a moment that when Prof. Bang replies he will tell us there are cases that are not epizootic or infectious. Several speakers mentioned the fact that abortion had occurred through a pack of hounds running through a herd of cattle or a flock of sheep, and also from accident, and other speakers mentioned the question of the removal of the cleansing. Some years ago I had very large experience in removing the cleansing from cows which had aborted, and I must say, speaking from experience, I found it much easier to take the cleansing away on the second and third day than on the first day, and with much better results to the animals Another matter that has been mentioned is the question of isolation. I would like to go even further than has been suggested this morning in regard to the adoption of isolation. Speaking now as a Veterinary Inspector for a large city, more particularly employed with regard to the milk supply, I would say that not only should a cow showing premonitory signs of abortion be isolated, but that every cow about to be calved should be isolated. I do not think a cow should be left to calve amongst a herd of pregnant cattle. There is one reason I should like to emphasise the isolation of cows, and that is the horrible smell which accompanies the retention of the placental membranes. As we all know, milk absorbs bad odours very easily; and as a veterinary inspector in a large town I know that, in connection with the milk supply, if possible, it is advisable that no odours should get into the milk. For that reason I think where the placental membranes are retained the cow should be isolated.

Mr. Cameron was rather diffident about educating the farmers, because he said they might say it would affect the veterinary surgeon's pocket. I do not think he need be diffident at all. Farmers and owners of horses and cattle have become acquainted with the contagious nature of infectious abortion ; they know it is an infectious disease and that they must take measures to prevent it, and if the veterinary surgeons do not take those measures somebody else will step in and do so.

I think that Prof. Mettam mentioned the fact that a good deal of quackery is going on with regard to certain diseases, and he hoped it would not take place with regard to the preventive measures that are used for contagious abortion. I re-echo those remarks, and say it is the duty of the veterinary profession to educate the farmers in regard to the preventive measures necessary to combat the disease. Another matter connected with education is the legal measures which should be adopted. There is no doubt that the farmer, who does not care what he does for the sake of a pound or two—as one of the speakers remarked, wants educating, and he will only be educated by taking him into the police court. If infectious abortion was scheduled as a contagious disease, it would be much to the advantage of any measures taken to prevent it. As we all know, a Departmental Committee, not a Royal Commission, is dealing with this disease, and I have no doubt that, at the conclusion of their labours, when they give us their report, some legal measures will be advocated in regard to it.

Reply by Prof. Bang.

Professor Bang, who was received with cheers on rising to reply, said : My first duty, and it is a very agreeable one, is to return you my sincerest thanks for the extremely kind manner in which you have received me, and especially I want to thank most cordially my friend Professor Mettam for the all too kind way in which he has been good enough to refer to me. I also desire to thank the other gentlemen who have taken part in the discussion. I am very glad to find, as far as I have been able to understand their speeches, that most of them, perhaps all, agree with me in my opinions. There are some very small points where I differ a little with them, but not to a great extent.

Before I try to answer the many questions which have been asked, I want to demonstrate to you the organisms which produce the abortion. I have here in these glasses some cultures, Nos. 1, 2 and 3, from this organism, and you will be able to see the peculiar way in which they grow.

This is a tube containing a culture. They grow a little under the surface ; they grow in a layer more or less thick, and that you will be able to see in these glasses. I have put under a microscope in another room some preparations of the bacteria, so that you will be able to see them afterwards.

Now I will try to answer some of the questions. Prof. Mettam asked me if I had any experience of how long the bacilli may live outside the body and remain infective. I am sorry to be obliged to answer that I have no experience. I have had so many other things to do that I have not been able to investigate those points; but of course he is right in saying that the points are of great value, and I hope later to be able to give a better answer. I may answer exactly the same regarding the carbolic acid taken in through the mouth; I have no experience at all upon that question. Then he asked me if it were possible to immunise young calves, as far as I understood, before eight months. On that point I have some experience, because on a large farm in Sweden they have made, for a year or more, many experiments for the purpose of immunising calves. I have not personally seen the farm, but a former assistant of mine has taken care of it. The results obtained are not excellent; out of thirty-nine animals which they tried to immunise by the subcutaneous injection of dead culture, culture tried by Truro (?), fourteen aborted; and out of forty cases where the injection was partly subcutaneous and partly intravenous, the injection being made only a few times with very small doses of living bacilli, eight aborted. That is not excellent, but nevertheless it proves that the living culture is better for the purpose of acquiring immunity than a dead culture, as I have said in my paper. On this farm the immunisation was done on the young calves a year before they were taken to the bull, a very long time before.

Prof. Mettam raised a question on the point that if we get some method of immunising by means of cultures it is necessary that those cultures should only be used by veterinary surgeons. In that matter I am absolutely of his opinion; it would be absolutely impossible to give such things to other people than veterinary surgeons.

One speaker raised a question about abortion arising from other causes than infection, and another speaker asked me my opinion regarding the difference betweeu contagious and sporadic abortion. Of course, sporadic abortion exists. Nobody will deny that a cow may abort after an accident, or that a sheep may abort after a dog has run through the herd, and at the same time we know that foot and mouth disease and other diseases will produce abortion. It seems to me rather probable that different poisons may produce abortion in cattle, but I believe that that is only a rare case. I believe that most cases of abortion in cattle are really caused by the abortion bacilli; I believe it is only exceptional when abortion is produced in other ways. Then one speaker referred to the question of pools of bad water producing the disease. I do not believe that bad water will produce abortion, but, on the other hand, it is not impossible that small pools of water may be infected by cattle that have aborted and in that way produce abortion, just as food may be soiled in the same way.

Then a question was asked with regard to abortion in mares. You will notice that I did not say much about that in the paper. I only say that I made some experiments many years ago, which demonstrated that it is possible to produce abortion in mares by introducing the abortion bacilli from cows. In that case, I did it by injection in the veins, but I think I will be able to produce the same by feeding or in other ways. That does not at all prove that the common, natural abortion in mares is caused by the same thing; that I do not at all pretend. Last year I made some experiments on abortion in mares, and I must say that I have not been able to find my abortion bacilli in the after-birth or in the fœtus of an aborting mare. That is a fact which speaks against the idea that abortion in mares as a rule is caused by the same organism. For the present, I am mostly inclined to believe that the cause of abortion in mares must be another organism. It is a thing which seems to correspond to the observation of most of the speakers to-day, who told us that in most cases of abortion in mares they were not able to find aborting cows on the same farm; and in my opinion that speaks very much for the view that it is another organism which produces abortion in mares. With regard to abortion in ewes and goats, I believe it is caused by the same organism, because not only is it always very easy to produce abortion in goats and sheep by means of injection, but I also note, from experience in Denmark, that it sometimes happens that on the same farm where they have abortion in cows they also have abortion in ewes and in swine. We have very few goats in Denmark, so that I have no special experience I can bring before you in regard to them. That sheep are not so commonly affected is I think due to the fact that, as a rule, at least in this country, sheep are not housed, and therefore they have not the same opportunities of catching the bacilli as they have in Denmark, where we have a very small number of sheep, which are very often housed in the same stable as the cows.

Another gentleman asked me if I had any experience of a bull being infected through the mouth, through the food. I answer that I have no such experience, and I am not inclined to believe it would be possible in that way. I think the bull will only carry a germ from one infected cow to another; I do not believe that the bacilli will grow inside the body of a bull, and in that way be able to propagate.

Another gentleman asked me, from the standpoint of the ordinary veterinary surgeon in the country, if it is possible for him to distinguish the bacilli which causes abortion from other germs. I do not believe he will be able to do that, but, on the other hand, I do not believe there is any necessity to get this experience—I mean that every ordinary practitioner will be able to recognise contagious abortion if he examines the after-birth and if he sees the cow and its discharge. He will see the discharge, which you find before abortion and after birth, and on the outside of the after-birth and

chorion, and you find the cotyledons more or less altered. As a rule they are more red ; some of them have small hæmorrhoids in them, and you will find they alter in such a way that, as a rule, you will be able to say that it is a case of infectious abortion, even if you are not able to examine the exudate under the microscope, and to absolutely say " Here are the bacilli." For a man who is accustomed to use the microscope it is not a very difficult thing, at least if he gets the exudate in a fresh state. If the exudate is a day or two old, there will be an enormous number of other bacteria in it, and then it is not always easy to find the true bacilli. I may add that these bacilli are found very often in large cells. If you see such large cells you will often find them filled up with small organisms ; they look like micrococci, but if you examine them carefully you will find they are small bacilli with some spots If they are lying close to each other, they look just like micrococci, but it is not always the case. Very often you find the bacilli isolated, and then you find small coloured spots, or small bacilli, isolated, and in such a case it is not very easy to find them if there are many other bacteria in the product.

A gentleman disagreed a little with me when I said it was best to remove the after-birth the first day ; he said it was better to wait till the second or third day, and that it was easier to do it in that way. It may be that he is right. I have stated in my paper that you ought to remove the after-birth on the first day, because on the whole I think it is best to do so. We find in my country that the results are better if the after-birth is removed as soon as possible, because the longer the time which elapses after the birth the greater the other infections in the after-birth and the greater the danger of infecting the cow. But, on the other hand, I admit that it is difficult to take the after-birth on the first day after abortion ; in Denmark it is only possible in some cases, but I do not attach much importance to the point if you prefer to take the after-birth on the second or third day. It may be that you are right.

I fear that I have forgotten to answer many questions, but I believe I have answered most of them. If, however, there are some points which I may be allowed to answer afterwards, I shall be very ready to do so. (Cheers).

Mr. W. Woods: I have very great pleasure in asking you to accord a hearty vote of thanks to Professor Bang for his excellent paper. We have all learnt very much indeed from the paper, but the thing I have admired more than anything else was the fact that a Scotchman got up and spoke with the peculiar Northern intonation, followed by a Welshman who spoke with the peculiar Welsh accent, who was followed by gentlemen from the different counties in England ; and, in spite of their various accents, Professor Bang has been able to understand all of them. (Laughter). It is very

wonderful to me that a gentleman should come over from Denmark and be able to understand perfectly our different languages. (Laughter). I therefore think we ought to thank him, not only for the excellent paper he has prepared for us and his excellent speech in answering the questions which have been asked, but for the marvellous ability he has shown in understanding the remarks which have been made. I have the greatest pleasure in the world in proposing him a very hearty vote of thanks. (Cheers).

Mr. W. H. Bloye: I have very much pleasure in seconding the resolution which has been so ably proposed by Mr. Woods, and I am able to congratulate myself, as coming from the extreme Western corner of the Island, that Professor Bang has been able to understand a Devonshire man. (Laughter).

The Chairman: In putting the resolution, I should like to say that I desire to heartily associate myself with every word that has been said by the proposer and seconder of the resolution.

The resolution was put and carried with acclamation.

Mr. A. Spreull: If I am in order, I beg to propose that we confer upon Professor Bang the honour which we have conferred on a previous occasion upon Professor Ewart, and that is to make him an Honorary Fellow of this Association.

Mr. G. A. Banham: I have very great pleasure in seconding that proposition. I think the least we can do, when one of our foreign colleagues takes the trouble to come over to our meeting and prepare such an excellent paper, is for us to confer upon him the only honour which this Association has in its keeping. (Cheers.)

The resolution was put and carried with great enthusiasm.

Professor Bang: Mr. President and gentlemen, I thank you most cordially for the very great honour you have conferred upon me, and I thank you again for the very kind reception you have given me here. I feel extremely honoured and glad to have been able to come over and see you. (Cheers).

ANIMAL DISEASES FOLLOWING WAR.

By Lieut.-Colonel E. H. Hazelton, A.V.C.

Introductory: Animal losses during war: Accidents and surgical diseases: Communicable diseases of animals met with during and subsequent to warlike operations; Diseases not freely communicable met with in war time: Remarks on lameness: Sporadic diseases on active service; The Geneva Convention and horses in war time: Conclusion.

The subject of this paper, viz.: "Animal Diseases following War" is a very comprehensive one, including not only those diseases which are termed specific or zymotic, but others due to a variety of causes such as privation, exhaustion, accidents and surgical cases, and injuries incidental to campaigning. Diseases occurring on board ship, accidents which occur during embarkation and debarkation, disorders due to errors in feeding *et hoc genus omne*, these must all be considered.

We also have to consider the different species of animals used in war in relation to disease; horses of various types, mules, bullocks, camels, even elephants and yâks, all come under the care of the Veterinarian in some part of the world, for the sun is supposed not to set on the British Empire, and our wars are not confined to any particular country, but occur in widely separated areas. Thus we are also confronted with the problems of climates, which largely influence disease in animals.

It will be necessary to allude to diseases met with in tropical countries such as India, Burmah and Africa, in countries of arctic cold such as Thibet and North China, or of extreme heat and aridity, as Somaliland, it is therefore difficult to say very much in a paper of this kind on all the diseases we meet with, but I trust that the discussion which will follow may serve to amplify the remarks I have made and to fill the gaps which I have left.

Fortunately the discussion will be in the hands of many who have served their country, and who have had personal experience in the care of animals in time of war, and therefore it will be of deep interest to us all.

The greatest losses in war are not from the shot and shell of the enemy, but are caused by still more powerful foes, namely privation and disease.

The late war in South Africa was responsible for a wastage of animal life, probably unprecedented in the annals of any war of similar duration ; one reads of a cavalry regiment using up three thousand horses for its own requirements in the campaign ; of one thousand horses being destroyed as useless week after week, and these casualties were not due to disease proper but to privation and overwork. Perhaps this big casualty list was partly due to unsuitable material, but there is little doubt that it was largely due to the employment of unconditioned, unfit horses in work too hard for them. There was a want of time to get these horses fit. We all know how difficult it is to condition horses and how very easily they lose condition, and I hope that the lesson of South Africa in this connection has been learnt, for if we have to do it again, we shall again have to pay the bill, unless we do it in quite a different manner and do not attempt to carry on operations with unfit horses, gathered from all quarters of the earth, and subjected, as a preliminary, to at the least a 3,000 mile sea voyage.

The losses, either temporarily or permanently, in animals during campaigning from exhaustion and surgical injuries are always great and often unavoidable. I have known cavalry regiments almost dismounted because of sore backs alone ; not from badly fitting saddles or bad riding, but due to sheer overwork. It is easy to explain why these awful sore backs occur, but so hard to avoid their occurrence on a campaign.

Again, from ill-fitting pack saddles and badly adjusted loads on pack animals we find the same injuries to transport animals. It is no uncommon thing to find most of the skin of the hump of the camel adherent to the pack saddle on removal after prolonged marches, especially is this the case with hired animals and little expert supervision.

Enough now has been said on this subject, and when we look back down the long vista of warlike events, it does not matter whether it is in the Far East or nearer home, we marvel at the enormous roll of casualties, and we note the names of heroes among nations, but only those who have had the care of suffering animals in time of war can fully realise the heroism shewn by them in man's service, and all of us, as members of a profession second to none in its aims and aspirations for the relief of suffering nature, willingly pay our tribute of respect to the generous creatures who have, we hope, not laid down their lives in vain.

It is well known to us that, notwithstanding rigid inspections and the utmost care exercised by all concerned, if young animals, or even mature animals, are collected in large numbers from countries in which disease exists, it is only a matter of

time for such disease to appear in the mass, unless there can be an adequate system of quarantine imposed, which in war is often impossible. (I allude to zymotic diseases here.)

Disease of all kinds follows rapidly in the train of armies, mainly because of the massing of large numbers of animals which presents a fine field for the development of the causal organisms, also because these organisms are brought to the scene of operations through the various channels of animal supply, and by the importation of a new animal population there is always the risk of the contraction of indigenous disease which is probably just as important as any other factor.

In addition, then, to the accidental or surgical casualties of our animals during a compaign, both before and during operations, on lines of communication, and the actual casualties of battle, we have to consider disease in its most open aspect, derived perhaps from sources far removed from the theatre of war, and in order to do so let us consider the communicable diseases of animals during war.

Equinia : Glanders.

I think the disease which merits our early consideration is one we are probably most familiar with and which is practically always met with on a campaign, that is glanders. Glanders is no respector of countries. It is met with in temperate and tropical countries, in the east and in the west ; it does not vary in its manifestations wherever it is met with, but is the same intractable disorder to-day as it was in the past.

Yet there is a difference, not in the disease itself, but in the manner in which we now regard it. Glanders has lost its terrors to a very great extent now that it can be diagnosed with reasonable certainty by means of the mallein test. Formerly the only test we knew of was the test of clinical symptoms, and, moreover, it was usual to consider a unit, say a regiment or a battery establishment of horses, among which a clinical case had been discovered, as suspicious for many weary months, if not for years, and rightly so at that time, for there is no doubt that it is a disease of the gravest moment apart from the loss it occasions among animals, owing to the possibility of its transference to human beings.

Now, however, with mallein at our service it is perfectly possible in a few days to discover to what extent units are affected, to isolate all cases which re-act or which are suspicious without the tedious periods of watching and waiting which used to obtain.

This satisfactory state of affairs is of immense benefit during war, regiments are now free to move without dread of the

appearance of this disease among them except from renewed contagion, they are free to mix with other units and are not regarded as objectionable neighbours.

Another service that mallein performs is that of rendering the remounting of corps a non-fertile source of glanders, for remounts can be tested with mallein and declared free, which is a great advance on the methods of segregation which are not often possible on active service.

In order to illustrate some of the channels through which glanders may infect an army, I will give some personal experiences.

During the operations in N. China, 1900-01, after the occupation of Pekin by the allies, many hundreds of ponies and mules were captured by the different nations' troops; these ponies and mules had been abandoned by the Chinese during their flight from the capital. They were found in large numbers in the Imperial Hunting Park near Pekin, and many found their way into the transport lines of the Allies, subsequently many were found to be affected with glanders.

During the winter succeeding the operations, I saw the horses, ponies and mules of practically all the Allies, and I saw in the German stables numbers of cases of glanders, not only among the captured Chinese ponies and mules, but also among the Australian horses with which their cavalry and artillery were horsed. I also was asked to inspect the horses of a regiment of U.S. cavalry suspected of being affected, and was able, with the assistance of mallein, to detect the animals infected.

It is worth remark at this place to note that the German veterinary officers placed but little faith in the efficacy of mallein, and the U.S. army in N. China then had no veterinary service.

In S. Africa glanders was one of the diseases met with during and after the war.

Owing to the very many and widely-divergent channels of horse supply, it is very difficult to say how frequently it was introduced from without, but it is very evident that there was widespread contagion, for after the cessation of operations large numbers of cases were detected in army horses in the country, and during the year 1903-4 ten centres were located and 165 cases discovered in horses and mules, the majority of these being brought to light on the final testing of the army horses with mallein. (See Annual Report A.V.D., 1903-4.)

During the following year, 1904-5, the disease was noted in only six centres, and the number of cases found had dropped to 33.

The disease was detected among transport ponies during the operations of the Sikkim-Tibet mission in Thibet, 1904, but was readily controlled.

During the operations in Somaliland, 1904, glanders was not prevalent.

I think that enough has been said to show the remarkable extent of area over which glanders may exist. Climate appears to exercise no influence over it either for good or ill; it is the same in the tropics as in the frigid climates of N. China and Thibet, but glanders now has no terrors for the veterinarian compared with the days when mallein was unthought of, and as a scourge of equines it need not be accorded the premier position it so long has occupied, because it may now be considered as a controllable disease when conditions are fairly favourable for a systematic attempt to suppress it.

Scabies or Mange.

There is no communicable disease affecting animals in time of war that causes more trouble than mange. It is practically impossible to avoid this disease on active service. All varieties of animals may become affected, and it is the most readily communicable of all diseases that I am aware of.

The conditions under which army animals are placed on active service are often most favourable to the development of scabies; a contaminated camping ground or stable may start it, and it will spread like a fire and no one will be able to say when it will stop.

Horses, mules and camels, especially the latter, are generally attacked. From various reasons we cannot always get our animals groomed on active service, and a dirty horse is a favourable habitat for the parasite of the disease. Everything with which that horse comes in contact—saddlery or harness, blankets, and brushes—all help to carry on the parasites. Once let a camping-ground be contaminated, then all others using it are liable to contract the disease.

It is just the same with stabling or shelters of any kind, bedding, litter, sand: in fact anything used by infected animals can act as a carrier of the contagion. Even the troopers or attendants will suffice, and once this disease is established only the most thorough and careful measures will prove successful to stamp it out.

Consider the difficulties to be overcome in an army in the field. It is all very well to say isolate, segregate, dress them all over with anything you may prescribe, but corps have to march, troops have to manœuvre and fight, every transport animal is wanted for the lines of communication. They must go on, and so does the disease, and when time and opportunity for treatment arrives, the disease has got a good start, and as I have remarked, there is no disease which gives more trouble to the veterinary staff than does scabies.

Animals sent to hospitals, depots on lines of communication or at the base, carry it with them, and where they are collected in large numbers mange is a pest.

On service the disease is difficult to treat for the reason that it is difficult to obtain large quantities of oily dressings which are the stand-by of the veterinary attendant in its treatment, for although there are many remedies advocated, yet those which do not contain an oily base are not so efficacious as those that do, and to trasport the quantity of train or fish oil necessary, say for the dressing of a thousand camels, is no light undertaking.

Of the varieties of scabies the most intractable is the sarcoptic form. We meet with it all over the world, it is common in tropical countries at all seasons, in sandy and arid tracts such as the Frontier of India, Somaliland and Egypt it flourishes.

South Africa can tell of countless numbers of animals affected and it is not unknown in England.

Rinderpest or Cattle Plague.

Before armies take the field the problem of feeding them has to be faced. Western men, such as men of European nations and the Americas, are more difficult in this respect than are Easterns, for the reason that the former depend so largely on animal food for sustenance. Whereas the men of Eastern nations can live and fight on a diet in which animal food does not play a very prominent part, also, although the diet of Western troops in the field largely consists of meat in the canned or preserved condition, yet fresh beef and mutton are desirable and have to be provided when operations are long continued, therefore cattle for slaughter purposes are collected in requisite numbers and follow armies to be killed and consumed as desired.

Among these herds rinderpest often occurs. Bullocks are largely used for the transport of an army, for draught and pack purposes in various parts of the world, notably in India and South Africa.

Bovines, such as the yâk are used as pack animals to carry the necessaries of an army in the Highlands of Thibet, on the hills and plateaux of Western China and Sikkim, and in these regions rinderpest is met with.

The disease is generally considered to be enzoötic on the Steppes of Russia, but it may be considered to have extended its habitat to the entire continent of Asia, for it is common in China, Asiatic Russia, India, Burmah, and Central Asia, and it is also met with in the continent of Africa.

Slaughter cattle purchased in the province of Shan Tung, south of Pechili, brought the disease to Pekin during the war

(1900-01) and caused severe losses among slaughter cattle on the lines of communication and at Pekin.

This disease is one of grave importance by reason of its extremely virulent nature when it is first encountered. It very rapidly spreads through a herd, and the most approved method of dealing with it is to render animals immune by the preventive inoculation of a serum. Unfortunately there are times and occasions when you have to deal with it and have not the serum at hand to help you This was the case in China.

Another difficulty with regard to this disease is the practical impossibility to prevent, by any means available on active service, the contamination of healthy herds by diseased animals on the lines of communication of an army. Convoys are passing in a continuous stream, cattle are driven from post to post, and it can be readily understood how very easily herds are infected along this line. Frequently the men in charge of cattle are labourers or coolies of low intelligence, and who know little of the management of cattle, and care less ; also the escort of these herds does not always hear of the orders issued until the damage is done, and it is often expedient to pass animals along as quickly as possibly by any means available, road, river or rail, regardless of precautions suggested for the prevention of disease. During the Sikkim-Thibet mission operations the bullocks were inoculated with a protective serum, prepared at the Government Bacteriological Institute at Muktesar (India), with good results.

In South Africa the bullocks used in transport operations were subjected to a similar inoculation.

Epizootic Lymphangitis.

This disease has been brought into considerable prominence during the past six or seven years, and there are Veterinarians in England who have not had any personal experience in dealing with it.

During operations in India, China, Thibet, and South Africa, to take the most recent wars as examples, it was frequently met with.

It will be necessary before speaking of it in connection with an army in the field to consider the disease itself rather more in detail than is necessary with most diseases, because it is not so generally well known as are others.

The causal organism of epizootic lymphangitis is the cryptococcus of Rivolta, a saccharomyces ; this organism flourishes in the lymphatic tracts and glands of the animal economy gaining its entry through wounds.

By its presence, irritation of the invaded lymphatics is caused, abscess formation occurs along the lymphatic tracts and suppurating sores result in many situations, these sores follow the course of the lymphatics and the appearances which result, have been, and no doubt will continue to be, frequently confused with the lesions of glanders-farcy.

It will be more convenient to refer you to a text-book on the subject for a more detailed description of the disorder, and we will now consider epizootic lymphangitis during war-like operations.

During the operations in China (1900-01) this disease was met with often, but it did not cause any widespread trouble or difficulty, cases were found, recognised and dealt with mainly by the destruction of infected animals, and no outbreak occurred.

In Somaliland, 1904, the disease was not prevalent; in Sikkim and Thibet it was met with and quickly controlled; and in South Africa it occurred during the recent war, but I imagine that it has given more trouble since the cessation of operations than it did during their progress.

This disease does not incapacitate an animal until it becomes a confirmed case, or one in which structures are involved which interfere with the fitting of saddlery or harness; the majority of cases do not present any appearance to note until some time has elapsed, the wound originally infected will usually heal, and it may be three or more months afterwards that the organisms become actively aggressive, it therefore is not a disease which will cause much disturbance in the plans for mounted operations in its initial stages.

Later on it is a different matter, in cases of some standing the appearances may resemble a confirmed case of farcy. I have seen infected horses with hind legs of enormous size. The lymphatic tracts in the inguinal region swollen to the size of one's arm, ulcers of varying size, extending from groin to foot. More frequently an insignificant abscess or two are seen on withers, or at the point of the shoulder, may be around a stifle, or surrounding an eye, the peculiar thing is that they do not quickly heal, they persist, and others form in the neighbourhood until a formidable case is under treatment. I have met with two severe outbreaks due to castration. Colts are operated on, the wound heals and they are sent to regiments, batteries, transport corps, etc., and some months afterwards when with their unit, it is found that a crop of pustules has developed in the neighbourhood of the scrotal wound, and practically all the batch of colts operated upon at that time or place are found to be affected.

It will be noticed that this disease is one of somewhat prolonged incubation, and herein lies one of the chief difficulties in dealing with it, as it cannot be diagnosed until clinical symptoms appear.

Another feature which presents grave difficulties in its prophylaxis is the liability there is to recurrence in cases of wounds after treatment when the animal is apparently cured. This also leads up to the point as to whether it is advisable to place cases under treatment, or to stamp it out by the destruction of infected animals.

In war time if cases can be diagnosed early, it is no doubt best to destroy and cremate them in order to diminish the number of centres of infection; during the stress of campaigns it is impossible to treat the disease with much success, but a very great deal may be accomplised if it be realised that in practice it only spreads from wound to wound. Even if the disease is present it is not impossible to keep wounds covered or protected and to avoid passing on the contagion by the hands or dressings of veterinary assistants or others employed in dressing wounds. It is difficult to ensure this extreme care.

The time comes after operations have ceased, when there is no necessity for the movement of troops, suspected animals can be placed under observation and the affected can be dealt with, but it is a work of years to finally obtain a clean bill of health. After a campaign this disease causes most mischief, when animals which have been through the various operations return to other countries, and may carry the contagion with them, and I need hardly say that this is a matter of very great importance and one which is engaging the attention of many both inside and outside our profession.

Epizootic lymphangitis is known in many countries, it is found in Japan and the Far East; it has been enzoötic in Burmah for years. In India it is common; an undoubted outbreak is recorded in 1894 by Moore and Clarke, it is said to have been noticed in South Africa before the war, it certainly was there after the war, and many parts of Europe are known to be affected with it, to the last we must add Great Britain and Ireland.

"Kumri" or "Windstroke."

This is the term given to a disease met with in campaigns in Eastern countries, and during the operations which culminated in the annexation of upper Burmah it caused very great losses in horses of Indian Cavalry. I can find no account of this disease having been met with in other countries. It used to be very prevalent in India both in the

North and in the South, generally affecting the horse, although mules may also become affected, but cases are not so frequently met with in these animals.

I have seen it in the Deccan, and in the coastal districts both East and West in the Madras Presidency ; in Malabar and Cochin it was very common in the eighties, but I did not meet with it so frequently during the next decade.

The name "Windstroke" is applied to it because it is held by the natives of India and also by others, that the cause of the symptoms met with was a prevailing wind at certain seasons, generally a land wind which blows at regular intervals and at known hours and direction.

The symptoms presented are those of paralysis, sometimes a paraplegia, often general paralysis with complete loss of control of limbs and movement, and later on complete paralysis. One generally notices a want of control of a hind limb or limbs as a first symptom, frequently the attack is sudden and the animal is found in the morning quite unable to control its limbs or head, if lifted into a standing position it is so helpless that it cannot maintain itself there, but limbs and spine are of indiarubber-like flaccidity.

At other times the attack is not so severe, and beyond a slight loss of muscular co-ordination there is not much to be seen.

The treatment of cases is of little avail, one imagines sometimes that improvement is occurring, but the majority of cases treated do not improve, and are destroyed sooner or later.

I am not aware that there is any recent literature bearing on this disease. I think that, judging from other animal disorders, it may be found that "Kumri" is a disease which will be referred to the class of disorders due to the presence of infusoria in the blood. It has been my fortune to meet with it frequently, and I have made a large number of post mortem examinations, and on one occasion I sent sections of spinal cord to England for examination, with no illuminating results, for they were said to present no morbid features of any kind, and the sections I sent were taken from two most pronounced cases of the disease.

I have never found any marked changes in spinal cords I have examined. It is said in this disease one may find congested areas, increase of spinal fluid and degenerative changes, but I have not noticed these myself. I have a theory regarding "Kumri" but have never been able to substantiate it, and this is that it is due to "Filariasis."

To explain my reasons for holding this theory, I must first say that I lived in South India for many years and annually operated

upon a large number of horses for filaria in the eye, and I have noticed a case of "Kumri" complicated with filaria in the eye. I have also seen "Kumri" follow in animals from which filaria have been removed from the eye. Subsequent to the disease being established I have removed filaria from the eye, and further I have found these filaria or nematode worms in cavities of the body, abdomen and scrotum in horses destroyed for "Kumri," on post mortem examination; but I have never found them in the spinal canal or cord.

It is possible that larval forms of this parasite may invade nerve centres and cause the symptoms we see, but I only say it is possible, because I have failed to get confirmatory evidence to prove the case.

The disease is confined, so far as I can find any evidence to guide me, principally to India and Burmah, in the coast districts of these countries where the annual monsoon rains are very heavy and vegetation luxuriant, it also is met with in the dryer areas of the Deccan and parts of Northern India.

As regards its importance in campaigns there is no doubt but that in these countries it is a terrible scourge. I have said it caused great losses in the Burmah campaign of 1886, one regiment of Cavalry 500 strong, having lost nearly all its horses from this cause alone.

The disease known as "Mal de Caderas" (literally, disease affecting the hind quarters) met with in South America, and which is caused by the invasion of the blood by the *Trypanosoma equinum*, presents somewhat similar appearances to those noted in "Kumri" in India, and it is highly probable that the latter is due to a similar cause, judging entirely from analogy.

"Surra" (Vernacular, Rotten.)

This formidable disease has caused considerable loss during war and afterwards in India, Burmah and adjacent countries, and is one of a class of diseases of vast interest and importance not only from the point of view of the practitioner and veterinary pathologist, but also to the bacteriologist and entomologist.

The causal organism of this disorder is a flagellated protozoa or trypanosome (first demonstrated by Dr. Evans, A.V.D.) The parasite is found in the blood free in the liquor sanguinis.

The disease was investigated by Steel in Burmah in 1884-1885, and an exhaustive treatise on Surra has been published by Lingard comparatively recently. Surra is invariably fatal in equines, the disease usually running a protracted course with marked periods of intermission. The prominent symptoms are those of progressive anæmia.

In the camel surra runs a more protracted course than it does in equines, and the presence of the parasite in the blood does not cause the same serious sequelæ in all cases.

Surra exists in numbers of camels on the Frontier of India, in which it was not suspected, and an investigation on this matter was proceeding when I left India in 1904.

The Burmese campaign of 1884-5 was responsible for very considerable loss from this disease in cavalry horses, transport ponies and mules, and the areas in that country within the limits of which surra may be expected are well known.

Surra is also common in North-Eastern India and Assam. The disease has been known from time immemorial in Central Asia (Lingard) and nearly all over India. In French Indo-China it has caused the loss of many hundreds of camels in 1891-1894. In 1901 it was noticed among American Army animals in the Phillipines, taken there presumably by mules from the China expedition, which had subsequently been taken over to the Archipelago. (Nocard.) What mules these were I do not know, but they were not Indian Army mules, as far as I can remember, for these were returned to India on the conclusion of operations in North China. However, it will serve to illustrate the transmissibility of the disease, for we had no cases of surra diagnosed as such in North China. I will refer to this point a little later.

Surra is transmitted by biting insects, particularly, if not solely, by a dipterous fly, the *Tabanus Tropica*. Nocard states that no stage of evolution of the parasite takes place in the fly; little is apparently known of the life history of the trypanosome, it possibly passes some phase of its existence in unsuspected hosts or in outside media.

Surra shews a preference for the horse, ass and mule; it is common in the camel, is found in the elephant, cat and dog. Cattle are not so susceptible, but are not immune. Imported are more susceptible than are indigenous animals.

One attack does not confer an immunity when the animal recovers. Lingard instances a case in which an animal succumbed to a second attack of the disease. Surra is nearly invariably fatal in equines, treatment being of little avail. Arsenic is recommended. Prevention is possible if the infective areas are known and can be avoided. It is obviously impossible to do this in an enemy's country.

The Trypanosoma Evansii is similar to the Trypanosoma Lewisii of rats (not pathogenic). Steel found the parasite in the blood of transport animals from Burmah (ponies) in 1885 and I saw it then with him at Poona (India).

Regarding the outbreak in the Phillipines alluded to above, it is considered probable that animals, themselves tolerant of the disease, may pass it on to others and even to other countries. This will serve to indicate the enormous difficulties which beset the path of the legislator who would attempt to prevent its march.

Nagana, or Tse-tse Fly Disease.

Nagana, n'gana or tse-tse fly disease is well known in Africa and in many parts renders the breeding of domesticated animals impossible.

This disease is remarkably like surra, the difference being principally in the morphology of the trypanosome.

The causal organism is the *Trypanosoma Brucei* (demonstrated by Bruce in 1886), and this observer made clear the part played in the transmission of the disease by the tse-tse fly (*Glossina morsitans*), and the preservation of the virus in the system of wild animals. The disease affects the same animals as does surra. Cattle are less susceptible than equines : man and birds are refractory.

It is found practically all over Africa, principally in low-lying districts, in the neighbourhood of lakes, the courses of big rivers, and on the sea coast. The symptoms are similar to those of surra.

The tse-tse fly, having bitten a nagana-infected animal, conveys a trace of blood to the next animal it bites and transmits the contagion to it.

Flies carried from an infected locality to a healthy one carry the contagion with them, and they remain infective from 24 to 48 hours. No other fly carries the virus, and the geographical distribution of the fly and the disease correspond (Nocard.)

Bruce's investigations have proved that the blood of wild animals is at times virulent although no trypanosomes can be found in it, and it must be admitted that the blood of some of these animals is in a state of permanent infection. There can, in fact, be no doubt that it is from this blood that the fly obtains the germs of this disease, germs which are incapable of remaining more than 48 hours virulent in the fly, and which, nevertheless, are always prevalent in many districts of Central Africa.

It is probable that there is no immunity in these wild animals, but considerable tolerance of the parasite, which permits of the parasite living in the blood in small numbers without harm to the host. (Laveran and Mesnil).

The prevention of the disease is best attempted by the avoidance of the fly, and it is noticed that the disease and the fly are disappearing from areas coincident with the destruction of big game, such as wild ruminants.

Treatment is unsatisfactory, as in surra, arsenic appearing to have slight effect on the life of the parasite.

Nagana presented an insurmountable obstacle to the passage of convoys over infected areas, and I have therefore included it among diseases occurring during war.

We find that the flagellated hæmatozoöns or trypanosomata are the causal organisms of Surra, N'gana, Dourine (which I have not considered in this paper) and Mal de Caderas, and it may safely be prophesied that the list of diseases of the group Trypanosomiasis will certainly be added to by the discovery of other diseases due to these causes.

They are highly important to the army veterinarian especially from their great range and their transmissibility. Cattle for surra and wild ruminants for n'gana serve as preservers of the virus, and in this manner the contagion is kept alive, and transmission becomes easy when the other necessary factors, namely, the special flies, are included.

Biliary Fever.

Biliary fever is a disease which has been cleared up during recent years, and is one which was met with largely among army horses during the South African war. It is also quite common in India, or if not common, it occurs there frequently, and no doubt many cases which are known as bilious fever are attributable to the same cause.

The disease comes under the heading of specific disorders, and is due to a parasite similar to the malarial parasite of man and to the parasite found in Texas fever in cattle.

Four species of these parasites are known in Mammalia, namely those affecting horses, cattle, sheep and dogs (Nocard and Leclainche.)

These piro-plasmodia invade the blood and enter the red corpuscles which they destroy, and the hæmoglobin becomes liberated. Anæmia, hæmoglobinuria and jaundice are the result of the parasitic invasion. The mortality from this disease is not very great considering to what class the disease belongs; it is about 12 per cent.

Piroplasmosis is a tick transmitted disease.

It is probable that the horses of the country are congenitally immune, as the disease occurs only sporadically among them, while imported horses are generally readily affected. During the South African war Argentine horses appeared to be peculiarly liable to the disease, while English, Australian and New Zealand animals shewed this to a less degree, and the large American horses, brought over as Artillery remounts, were never affected (Nocard and Leclainche.)

The disease is usually transmitted during grazing; horses kept in stables are not so frequently affected; one attack is sufficient to ensure a lasting immunity. There is still a lot to be learned regarding this disease, and it is nearly certain that animals which have been attacked and have recovered, and show no symptoms of the disease or of illness, are capable of transmitting it to healthy animals.

Treatment depends on the symptoms met with. Quinine is considered of benefit when the parasites are present in the blood. Prevention of grazing in suspected areas and stabling at night are indicated as prophylactic measures.

Horse Sickness.

Horse sickness (African) is another disease met with during the late war in South Africa and it is still found there. Many regard this disease and the piroplasmosis termed Biliary Fever as identical; others think otherwise. I am not aware that the organism, supposed to exist and to cause this disease, has been yet demonstrated. Horse sickness is undoubtedly a blood disorder, the type to which it belongs is not accurately known, certainly the parasite of biliary fever has been found in the blood of a horse dead from typical horse sickness (Bowhill.)

The Government of the Transvaal are carrying out the immunisation of mules and horses at various stations in respect to this disease. The extent to which army horses suffered from this disease during the late war is not known with certainty, but in 1903 the deaths in the Transvaal from horse sickness in army horses amounted to 383; the following year shewed 83 deaths, and fewer still in 1905.

The precautions necessary to prevent this disease consist largely in the provision of stabling and the prohibition of grazing at night in the districts in which it is prevalent.

Epizootic Aphtha, or Foot and Mouth Disease.

When a large proportion of transport animals on a campaign consists of bovines this disease is one to be reckoned with, for it causes a more or less complete breakdown in these animals when they become affected. It is also so extremely contagious that it spreads very rapidly and is difficult to control. Fortunately it is a disease of a mild character, although occasionally considerable mortality will occur from its sequelæ.

Epizootic aphtha may be described as a specific contagious disorder, characterised by symptoms of a febrile nature, and accompanied by an eruption on mucous surfaces, generally on tongue and gums, and at the junction of hoof with skin and between the digits.

It is generally observed in ruminants but is not confined to them, horses, elephants and man may be affected.

There is a recorded instance of a disease simulating this during the American war between North and South, in 1860-63 ; before the battle of Manassas the confederate cavalry were rendered useless in consequence of a disease which broke out among their horses which affected their mouths and feet ("Stonewall Jackson," Henderson.)

As far as transport bullocks are concerned this disease causes great trouble, the principal losses occurring from suppurating coronets and loss of the hoof, generally the result, when it happens, of the wounds becoming fly-blown.

It is also to be dreaded among the herds of cattle maintained for slaughter or milk. A somewhat severe outbreak occurred during the China expedition among the slaughter cattle on the lines of communication, and at Pekin ; there are records of this disease affecting cattle and elephants during the Afghan wars, and in the Indian frontier campaigns. I have no doubt that it was met with in South Africa during the late war.

Specific Ophthalmia.

Another disease met with during and after the South African war was specific ophthalmia. This disease is rather prevalent in army horses in South Africa, and also in mules: indigenous mules are apparently rarely affected. The disease is assumed to be due to a specific organism, but more investigation is necessary.

Diseases not readily Communicable.

Tetanus is a disease which is common on active service. It does not occur as an epizootic, but it is met with in sufficiently frequent instances to merit inclusion among the diseases which are discussed in this paper.

Tetanus may be considered a disease nearly invariably fatal. If the animal's system is strongly impregnated with the toxins of the bacillus tetanus and the symptoms peculiar to the disorder are strongly in evidence, the chances of recovery are remote.

Considering this disease among animals in war time, we find the most frequent cases in transport animals, such as mules and ponies. This may be explained by the fact that they suffer most from sore backs, galled withers and girthplace, treads and injuries to limbs and feet, and are generally in numerical superiority to other animals on a campaign ; moreover, they are often housed in huts or dwellings vacated by human beings, being smaller than horses they can be closer packed than can larger animals, and shelters which are not suitable for horses can be utilised for them.

I have often thought that mules are more susceptible than are other animals to this disease; but I also think that the reasons just given may account for the greater frequency of the disease among them on active service, and perhaps it is not a fact that they evince greater susceptibility than other animals. It is well known that the bacillus tetanus exists in abundance in the soil, and especially in the soil of the floors of human dwellings, this is particularly true of Eastern countries.

During the China war, after the conclusion of active operations, the transport mules and ponies of the British contingent were quartered in large numbers in the abandoned houses of Chinese in Pekin, which were converted into transport lines and stables during the winter, and from these stables the greatest number of cases of tetanus were admitted to treatment or were disposed of.

These cases were of such frequent occurrence, that particular care was taken in the disinfection of wounds on these animals, in order to minimise the risk of infection.

Tetanus is not a freely communicable disease, and after a war there is no probability of it assuming epizootic proportions.

Lameness.

A short account of the common causes of lameness on active service, will only be necessary, because, although the conditions may vary somewhat yet the causes of the lameness are similar to those occurring in peace time.

I place Laminitis first on the list of lameness, as one meets with this cause of disability to work very frequently. When long marches are performed it is a very serious condition, for rest is very essential in the treatment of severe cases.

There are hundreds of cases met with which have to go on when suffering from the affection in its sub-acute form, and many of them are benefited by work which is not too severe for them. Often these cases become chronic and are able to march day after day and eventually the usual alteration in the foot occurs, the sole becomes pumiced, and they may or they may not be of service, this depends largely on the extent of the structural deformity.

The causes of laminitis are generally attributable to overwork, especially in hot weather, long hours on the road in harness or under saddle. Acute cases are often best destroyed, so much depends on the facilities for treatment. If they can be treated it is worth while doing so, but if they have to be left without treatment it is more merciful to put them out of their pain.

Sprained tendons and ligaments are comparatively infrequent in seasoned horses, they result from the ordinary causes, and are, as a rule, amenable to treatment.

Accidental punctures of feet are common, and are readily treated. The shoeing of horses on service is carried out with a certain amount of difficulty. The forge cart of mounted units is very heavy; the worst horses are often told off to take it along, and it is generally last in to camp in consequence. Feet do not last unless carefully shod, and the old adage applies forcibly on service that "Where there is no foot there is no horse."

Other lamenesses do not call for special mention.

Sporadic Diseases.

Sporadic diseases met with are those seen daily in time of peace. "Digestive" diseases are not frequent, horses do not usually get overfed on campaigns, they also get lots of regular work and so keep healthy in consequence. Colic naturally occurs at times and usually yields to the ordinary treatment. "Respiratory" diseases are not common; open-air treatment suits the horse, and all through the severe winter in North China diseases of this class were infrequent. It is most astonishing to note the adaptability of horses to extremes of temperature, on board ship, in the tropics, horses are subjected to extreme trying heat, the same animals a few months later may be exposed to arctic conditions. These two extremes we noted in the China expedition, and I marvelled at the manner in which they were met. I think horses stand cold weather better than heat, but they will thrive under each condition when well cared for.

The same applies with even greater force to the mule, he is very hardy, and is the best transport animal in any country, always ready to feed or work, a great desideratum.

* * * *

I should like to draw attention to a movement which is now on foot, and which is promulgated by the Church Society for promoting kindness to animals, for the purpose of extending the terms of the Geneva Convention so as to include "Animals" among its provisions, and so to extend its protection in time of war to those in attendance upon them when sick and injured. Apparently the greatest sympathy is shown to the proposal by the representatives of the powers, and I personally can see no objection to the desire for the inclusion of those working in the field for the welfare of army animals in the provisions of this Convention, and I hope it will soon be an accomplished fact.

* * * *

In conclusion, I wish to say that I have tried to furnish material for discussion on diseases of animals in times of modern war. I was unfortunate in not being in South Africa during the late war, but I feel sure that many here can give their own experiences in that country, and that therefore my want in this respect will be fully atoned. My own experiences have been gained in India and the farther East, as you will have probably noticed.

I at one time intended to gather some information regarding animals in war time in the early part and middle of the last century, but after wading through many interesting books and being much edified by the perusal of the despatches of many fine soldiers, I came to the reluctant conclusion that "Tactics" should have been the heading of this paper if I was to continue this line of research, and so I have written what I have written. Would it were worthier. My hope is that it will lead to a discussion of interest to the profession, and so I leave it.

Discussion.

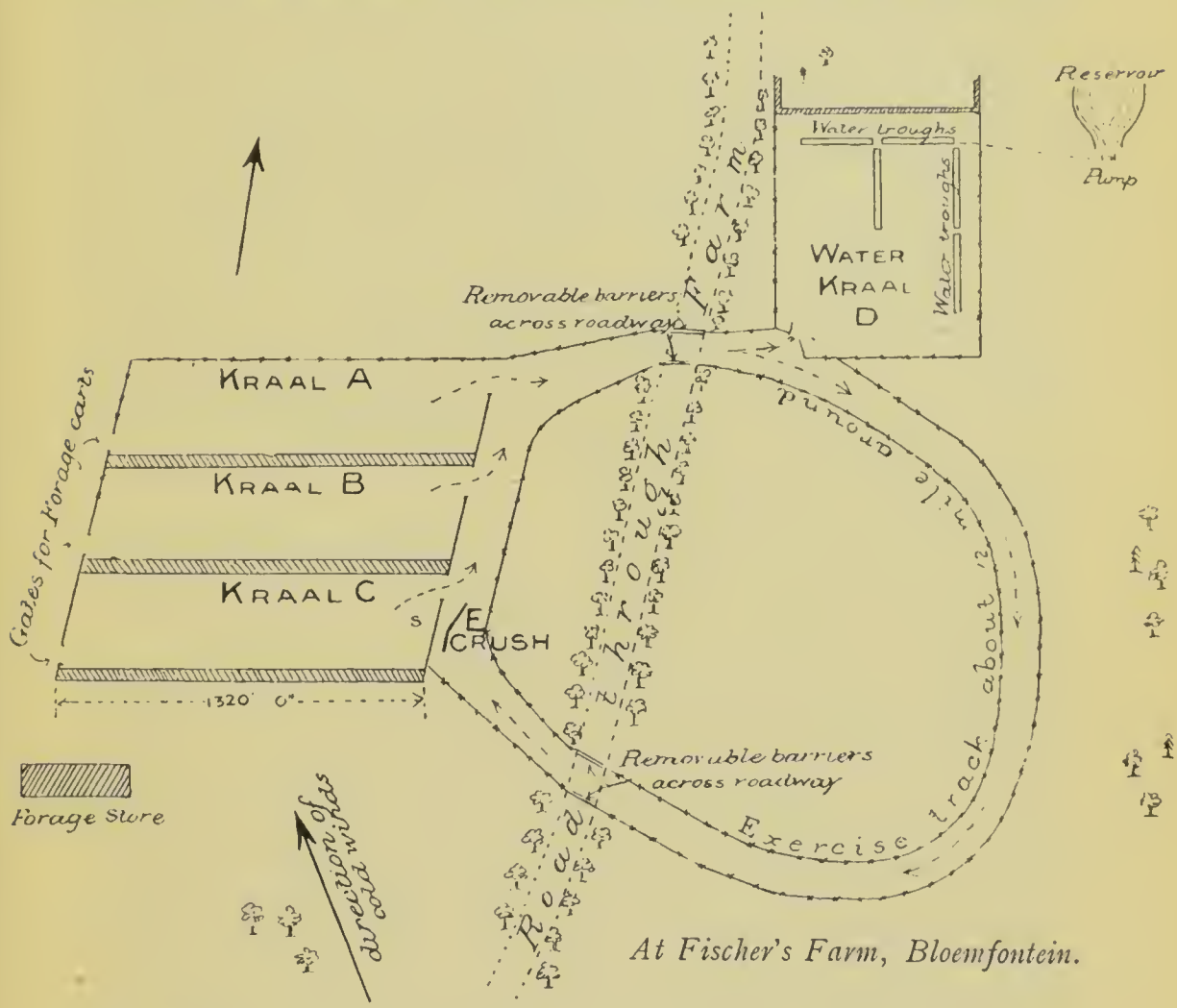
Mr. Stafford Jackson said: In the first place I must offer my most hearty congratulations to Col. Hazelton, and also the thanks of this meeting, for the very able and instructive paper he has just read. In my opinion, the subject selected was out of the common run, and yet one from the discussion of which much practical benefit can be derived, and with Col. Hazelton I hope that during the discussion we shall have the views of those who have had personal experience in the care of animals in time of war. Col. Hazelton has given us an exhaustive account of the numerous and varied diseases which occur during and at the seat of war, and these are most interesting. In my opinion, the first point to look to in dealing with disease is to do what we can in the way of its prevention, and in discussing the wastage of animal life in our own late war Col. Hazelton remarks: "Perhaps the big casualty list was partly due to unsuitable material." That coming from a man holding the important position Col. Hazelton does, together with the experience which some of our profession had in dealing with remounts before they left this and other countries, must suggest that more care might be taken when the purchase of the animal is made. The ill-conditioned and weak are the greatest curse as carriers of disease when large numbers of animals are brought in contact, and as all parasites thrive best upon the weak, so among the external diseases, mange, ringworm, and lice spread with great rapidity. Then strangles and other diseases generally follow as a result of exposure and fatigue; but surely the casualty list could be kept within bounds if the material supplied was good to begin with.

Through war many diseases which otherwise might have remained practically in obscurity have been brought before our notice, but the civil veterinary surgeon has little or no experience of these diseases ; and therefore it will be of very great interest, to me at any rate, to listen to the remarks which will fall from those of our profession who belong, or have belonged, to the Army Veterinary Department.

In again thanking Col. Hazelton, I rejoice with him that in order to minimise the horrors of war a movement is on foot to extend the terms of the Geneva Convention to include animals—a movement the success of which I am sure every man in this room has at heart. I have only one regret, and that is that the duty of opening the discussion was not placed in abler hands than mine.

Major Eassie : Col. Hazelton alludes to a point of supreme practical importance in the introductory portion of his valuable paper. I refer to the fixing of the responsibility for the enormous wastage of horses in war to the fact that they are issued out of condition. In this state they are not only worthless for the time being to units fighting for existence in the face of an enemy, but they are actually an encumbrance. They not only fail for the purpose for which they have been bought and carried so far—a fact which necessarily lowers or actually destroys the motive of a cavalry force—but they have to be replaced at once by other horses. One result of this state of affairs is an enormous increase in the number which has to be supplied, and this carries with it greater difficulties as regards organisation, and greatly enhanced opportunities for the occurrence and spread of diseases. If, on the other hand, a high percentage of the reserves of horses purchased are enabled to reach the army in the field in a state of fitness or condition, their usefulness is not only assured, but their life as fighting machines is indefinitely prolonged ; and because of this the magnitude of the actual supply is reduced considerably. The point for practical consideration is how horses collected together in thousands are to be made fit and kept fit against the time that they are actually required to be issued to troops in the field. It may be said at once that this cannot be done except by simple arrangements, so simple that if they are standardised they can be put into practical working order, at short notice, and under every difficulty, all along the line. It must be plain to you that exercise is a necessity. If this is not arranged for, how are thousands of horses collected together in one place to be got fit ? Similarly, watering, feeding, and every other duty must be so simplified that they can be done in the case of thousands of horses at a time, literally like clockwork.

It was my good fortune in the late war to have a free hand to make such a machine, and if you will allow me I should like to explain, as briefly as I can, how it can be worked, and how it attains the object of conditioning horses, and at the same time renders control of disease a relatively simple matter. I will pass round for your inspection a rough isometrical sketch of the machine. The idea is to abandon every attempt to



At Fischer's Farm, Bloemfontein.

deal with horses as individuals, and to manage them collectively in lots. One must be prepared to carry out as a complete day's work the conditioning of several thousands of horses without the possibility of falling into arrears, and to do other necessary work incidentally without dislocation of the main objects of exercise, watering and feeding. One must also be prepared at any moment to put one's hand upon, say, five hundred fit horses, and to issue them, in an hour or two, shod and ready for the road. At the same time one must be prepared to accept without notice as

many as five hundred horses collected from any source, and to put them at once into training for war, accepting responsibility for all disease, undeclared at the time, which may be amongst them. Unless all this can be done, and so simply done that anyone can do it, it is beyond question that horses will never be issued fit in a great war.

Diagram. A sketch was reproduced on the blackboard.]

It will be seen that there is a circular exercising track into which a number of enclosures lead by way of wide double gates. In these enclosures, A, B, C, D, E, horses are kept loose. The ground is either sandy or made equally suitable by laying down cinders. The enclosures are up to 300 feet wide, and extend back indefinitely according to the number of horses the depot is meant to deal with. There may be, for example, 250, 500, or 700 loose horses in each of the enclosures. It matters little so long as the space per horse averages at least 40 square yards. In each enclosure there is a long shed to afford shade and shelter. Under this is a row of feeding troughs, and another in the open. It is essential that the troughs should be in excess to allow the horses to feed quiety. Enclosuses A and B are reserved for new arrivals.

There are two separate watering places, W_1 and W_2 into which the horses are allowed to go, about 250 at a time, to water. Beyond these watering places are yards, S_1 and S_2, into which lots of horses, having watered, may be shunted out of the way. W_1 is reserved for new arrivals.

Horses are exercised by letting about 250 at a time file, at their own pace, into the track. Their movements are confined by the boundaries of the track, and they are continually on the turn. Their movements are not hastened, and they are left entirely to themselves. By the time that the last of the 250 have entered the track the leading horses will be half way round.

The two or three mounted men who manœuvre them merely ride with the procession and prevent an odd one from breaking back. By this time there will be an endless file of moving horses.

The problem which now presents itself is how this movement can be brought to a close. It is clear that they cannot be returned safely to the enclosures they were taken from, because their movement would be checked when they are re-entering. It can only be done by diverting them into one of the watering places, when they will leave the track as they entered it, at a tangent to the circle of movement, and will stop of their own accord at the watering troughs.

I have said that there may be 250, 500, or 700 horses in any one enclosure ; that is to say, one, two or three lots of 250 to be

exercised and watered. It becomes possible to water the three lots in turn because each, as it is finished watering, can be shunted out of the way.

While this proceeding of exercising and watering the lots of horses in succession has been going on, carts have been filing in to the enclosure by a gate at the back and dropping bags and bales at convenient intervals. When there are no more horses remaining in the enclosure this forage is distributed by a gang of about thirty men. It is a point gained that this is done in the absence of the horses. By the time the horses are all exercised and watered, the feed will be ready put out. It remains only to let the horses back from the watering place and the shunting place to feed. They return in a direction opposite to that in which they left for exercise, consequently they re-enter the track and leave it again always at a tangent to a circle. They are consequently never for a moment checked from the beginning to the end of the manœuvres. For the second time, moreover, their movement is terminated of their own will when they stop to feed at the troughs.

The exercising, watering, and feeding of the horses are, in this way, carried out automatically and the sequence cannot be upset. They travel a distance to water, get their fill of water, and return to feed at their leisure. The conditions as regards these events are entirely natural.

The few men that do this work in the case of one enclosure full of horses are available for the others, A, B, C, D, E, in succession. In this way 3,000 horses can be exercised, watered and fed in the early morning before breakfast time. This is repeated with the same men at about 11 o'clock in the forenoon, and again at 4 o'clock in the afternoon.

Horses take to this mode of treatment readily, Because they are kept in regular and sufficient exercise they are always quiet, and accidents are practically unknown. They get abundant rest, and they benefit in more ways than one by being at liberty.

On the other hand they are saved from illnesses and injuries which result from the wholly unnatural condition of being tied up. The continual exercise and the lying about on sand or cinders determines a remarkable cleanliness of the coat and the health of body and skin is proclaimed by the earliest appearance of a good coat. It was my experience that neither ringworm or lice, or even mange, could be grafted on the skin of horses kept under these conditions.

With the guarantee of regular daily exercise it becomes safe to feed the horses on a hard grain ration increasing in amount. They digest a maximum of the amount given to them with the least possible accumulation of waste products in the system. On

account of this, owing also to the continual mechanical movement of the gut resulting from freedom and exercise, and finally because the sequence of exercise, watering and feeding is irrevocably fixed, colic is literally unknown. The horses are in the open air and have yet the advantage of protection from cold and sun. At the advanced depot of which I had charge in Africa, I do not remember to have seen more than four or five cases of catarhh amongst upwards of 40,000 horses in three years, and I saw no strangles or pneumonia.

It is necessary at this point to explain how the loose horses are caught or handled. To do this one hundred at a time from A, B, C, D, or E, are brought to a point in the track where there is a special contrivance for the purpose. This has been elaborated as a result of careful observation over a long period, of how it can be done best and with the least chance of injury. The horses are not coerced in any way, but they find themselves between two sets of gates which close across the track and imprison them in a kind of yard. This leads into another yard by an opening 15 feet wide. This second yard is divided up by a V-shaped projection and beyond this it converges into a narrow gangway 24 inches wide and long enough to hold about thirty horses in single file. The horses glide of their own will from the yard into the second compartment, past the V-shaped buttress, into the long narrow gangway. Along the left side of this there is a step which enables the men to handle and secure them. They are then led out of the end of the gangway into the track again, the while another 30 horses or so take their place in the gangway from behind. In this way the 100 horses can have head collars put on to them and can be led out and put in line in eight minutes, or, with head collars on, this can be done in three minutes against time.

It remains to describe the arrangements for shoeing the horses. These consist of two enclosures placed side by side with a forge between the two. In one of the enclosures there is a catching-up place similar to the one already described. Horses to be shod are put into the first of these enclosures, up to 500 at a time. They are caught as required, shod, and let loose in the second enclosure. There is thus a check upon the amount of work which is being done in the forge. Moreover, the horses, whether in the first or second enclosure, are bound to be regularly exercised, watered and fed the same as if they were in A, B, C, D, or E.

When horses arrive at the depot they are examined and let loose to water in W_1. When their feed is ready they are transferred to A. In a day or two they are malleined by means of the catching-up place, and are then put into B. In B they are

observed for the reaction. They are then put through the forge to rectify defects of the feet. They then join other improving horses in C. In three weeks they will be found amongst the fit cavalry horses in D, or the fit artillery horses in E. In anticipation of the demand for the issue of fit horses, a number from D or E will be passed through the forge. On arrival of the party to take them over, they will be taken to the catching place in the track, caught by the men of the establishment, and handed over properly tied for the road. They will be fit horses, not liable to laminitis, and in a large measure resistant both to hardship and disease. From the first day they arrive until they are issued out they have been under full observation, because all horses in the whole system must pass in review many times every day. It is impossible that a horse can be hidden, and disease is in this way found out in its earliest stages, and in most cases before it arrives at a communicable stage.

Such is the standard depot for reserve horses. It may be large or small, situated in a tropical or in a cold climate; meant to deal with horses in peace or war; for young horses to be got over their first diseases, or for older horses to be got into or maintained in condition. The principle remains the same. Instead of being allowed to go back in condition, horses are being continually improved. Immediately they are purchased they can be put into A at the port of embarkation and shipped on demand from D or E. On being disembarked at the port in the country which is the seat of war they are put back into A.

After automatically arriving again in D or E, they are selected for transfer to an advance depot.

The more depots they are passed through the fitter they will be to undergo the hardships of war and the more certain it will be that they are free from the suspicion of disease.

The next most important point is the organisation of veterinary hospitals in war. The real object of these hospitals is to return to the service in as short a time as possible, the horses that are sent in to them for treatment, if possible in such a condition that they also are fit to take their place in the ranks. Where thousands of sick horses are collected together in one hospital, the need of simple means of managing them is even more necessary than in the case of presumably healthy horses. Here we have hundreds of sore backs and other wounds that would benefit by exercise, and which would recover immeasurably more rapidly if they were placed under favourable conditions as regards rest, feeding, watering, shelter and shade. Put together, classified in different enclosures, they can be dressed at a crush and can be returned again. There is nothing to be gained by tying such horses up in lines without shelter and with

uncertainty of getting food, and still worse the uncertainty of getting water. Similarly, we have hundreds of lame cases that can be treated loose, and so get at least a measure of freedom. My own method in lame cases was to put them in a section like the shoeing section such as I have described. There was a central inspection place; the lame horses were passed from one yard into another, and the process, at any time, interrupted or resumed.

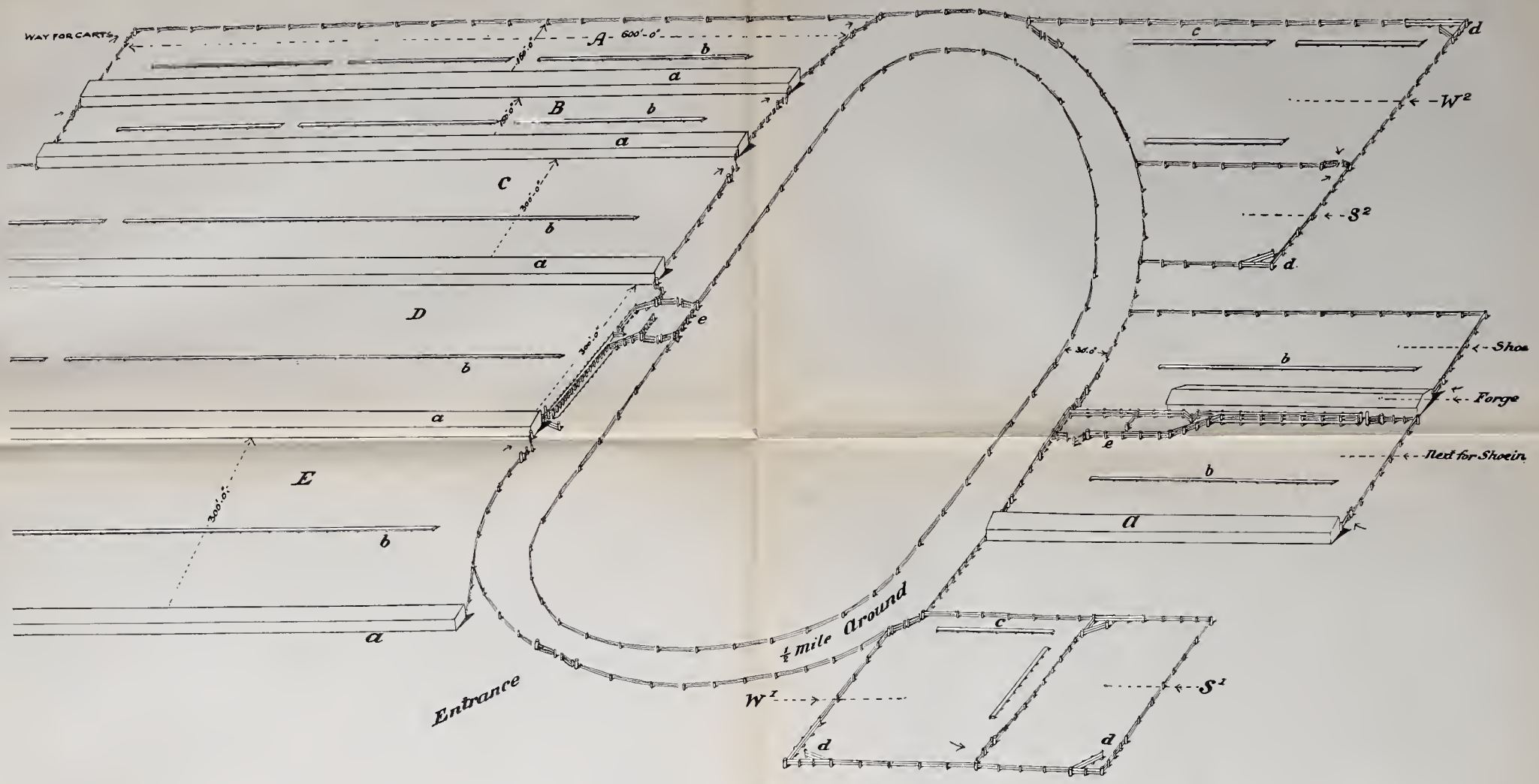
I am glad to say that all the veterinary hospitals are now run upon this system in Africa, and that they give satisfaction. It is realised by officers in units that horses are not only cured but that they are returned to them fit to take their places in the ranks.

Col. Hazelton has dwelt upon a disease which is a great complication in times of war, I refer to mange. To deal effectively with it, it is necessary to have separate mange depots in the veterinary hospitals for its treatment. I believe the reason why mange cases take so long to recover is that exercise is not afforded to ensure healthy action of the skin. Once under good conditions, a long way has been gone towards curing the cases. I had the opportunity of systematically treating mange upon this system in South Africa, and I must say with the best results. They were put in A, where they were treated for seven days; then they were promoted to B after being washed and re-dressed; and this broke the sequence of infection. From there they were passed into a third place, and in three weeks, or in certainly a month, ordinary cases of psoroptic mange could be turned out cured with certainty.

In the general organisation of horse management we have working together (1) The remount depot, (2) The Veterinary Hospital, with its isolation section, (3) The mange depot. A valuable suggestion, made, I believe, by Col. Blenkinsop, is the employment of the present Mobile Veterinary Hospitals which accompany columns in such a way that they start out with fit remounts, issue them as required, and take sick or disabled horses in exchange.

I would like to discuss many other points raised in Col. Hazelton's paper, notably transit of horses by sea, and systematic entraining and transit by rail, but I recognise that I have already taken up too much valuable time.

With regard to the detail of specific diseases gone into so ably by Col. Hazelton, I have one remark of a practical nature to offer which bears on what I have been saying: that malaria —biliary fever in horses—if it is endemic in a country, is responsible for more trouble than it is credited with, because every recovery from it is liable to exacerbations in intense sun heat, more especially if they become debilitated. I have seen in Burmah, India and South Africa thousands of horses stand-



PLAN OF AN ARRANGEMENT FOR "CONDITIONING" REMOUNTS FOR SERVICE, By MAJOR F. EASSIE, A.V.C.

A.B.C.D.E. Enclosures where horses are kept loose. They are classified in these enclosures according to their degree of fitness, etc. (*A* and *B* are reserved for new arrivals.)

W1. Watering place for horses from *A* and *B*.

S1. Place for convenience of shunting horses out of *W1* in order to make room for others.

W2. Watering place for horses from all enclosures except *A* and *B*.

S2. Shunting place beyond *W2*.

a.a.a. Shelter sheds, beneath these are feeding troughs.

b.b.b. Additional feeding troughs in the open air.

c.c.c. Watering troughs.

d.d.d. Culs-de-sac for catching individual horses that are seen to be sick or lame.

e.e. Catching-up contrivances.

National Veterinary Association, Liverpool, July 25th, 1906.

ing in the sun, every one of which had a high temperature. When such horses are placed in the shade the temperature at once falls, proving that the condition of fever is due directly to the sun. I have seen this condition, in Burmah, confounded with surra. So long as such cases remain in the sun, so long does the temperature remain at 103° or perhaps 105°. The high temperature being maintained by the rapid burning up of tissue, they will die inevitably unless they are removed to shade, or let loose and given the liberty to find shade.

Mr. F. W. Garnett: I would like to draw the attention of the meeting to the fact that we are supposed to be discussing a paper on "Animal diseases following war." What connection the greater part of the last speech which has been delivered bears on animal diseases following war, except the last few sentences referring to mange, I fail to see. I hope that we shall now return to the discussion proper on Col. Hazelton's paper, who has my fullest sympathies.

Mr. W. Hunting: I must say that I was a little disappointed at the remarks of the last speaker. If anything is necessary in connection with disease it is its prevention, and the whole scheme shown us by Major Eassie is, I think, the most perfect I have ever seen on paper for the prevention of disease. It seemed to me it was a most ingenious arrangement, almost automatic in its method of working; and if we could have had such a thing in the country where the horses were collected, and another through which the horses were passed as soon as they entered into the country in which the war was taking place, it would have saved us thousands of pounds in South Africa. And, in addition, the expense is simply trifling. It is said, I believe with truth, that during the South African war we lost 240,000 horses. 240,000 horses, without considering the efficiency which was destroyed by their loss, would pay for many of these stations and any quantity of men to look after them. Either Col. Hazelton or Major Eassie made use of a sentence which I thought was remarkably well chosen, to this effect, that the requirements for war are that you collect your horses, make them fit, and keep them fit until they are wanted. That is a scheme very difficult of achievement. We do not always see an attempt made to carry out these things in a sensible manner in this country. For instance, with regard to the collecting of horses, I noticed during the South Africa war that when horses were wanted, if you had a five-year-old horse, no matter how soft it was, if it was free from evidence of actual disease the army officials bought it; but the Government and the War Office strictly forbade a young veterinary surgeon of one year's experience to pass anything that was not absolutely sound. The result was that they had a horse

fit on landing in South Africa to do one day's work, and when he did three he died (Laughter). I am told that the best horses that were obtained in South Africa were those which had been at hard work, such as London van horses. But what about the London cab-horse? and there are thousands of horses in the country like him. A horse that earns its daily bread on the stones of London they said was not fit to go. Why, he is of all horses the fittest in this country; and they could have had thousands of horses from London cab-owners, from country veterinary surgeons, and country doctors, all fit to run for a man's life; but because they went a little dotty when they came out first thing in the morning, or were not sound in wind, or had one eye, they were not fit to go, but they would have carried a man a great deal safer than the other animals.

Then the question of the mixed responsibility in the army crops up. I believe the Army Veterinary Corps will have more power now, but I understand that even if a veterinary surgeon was sixty years of age and was sent out in command of a ship-load of horses, he required a boy of twenty-one called a combatant officer to look after him, and that gentleman used to leave it to the sergeant-major, so that when he was asked any question he he had to call up his sergeant-major to know what was meant. Then with regard to the transport corps, I do not know what training they have, but I suppose they tumble about in some kind of way in ordinary times, and when war comes on they, unfortunately, have to handle the horses. A friend of mine who was in the North-West Indian Provinces once told me of an order that was sent from up there for some horses to be sent on at once. The reply was made that no trucks were available, and a message was then received saying "Send them somehow," so they did. They packed them into ammunition waggons, which are air-tight, closed them down, and the horses all arrived dead (Laughter).

It strikes me that there are some practical difficulties which Major Eassie did not tell us about. He told us how he picked out the cases of strangles, of influenza, and the occasional cases of glanders, but what does he do with them? It seems to me that as he very often had 500 horses coming in he might have 100 of them down with influenza or catarrhal fever, and that he would want another place of about the same size to put them into.

Major Eassie: May I answer that now? There is a complementary place to that. There is a veterinary hospital alongside of it. Another point is that we rarely got, at least at the front, cases of strangles or catarrhal fever.

Mr. Hunting: One can quite understand that no matter what

arrangements you have, you have tremendous difficulties. If a combatant officer wants a hundred horses to carry his men somewhere or other in a hurry, he has got to have them if they can move at all. I suppose it is a fact that war will always be the same horrible thing—that you have to use lame horses, and sick horses, and anything you can get. I know that when a friend of mine who went to Kandahar took off his saddle he laid bare two or three ribs on each side of his horse: all the tissues down to the ribs came off with the saddle. That kind of thing is inevitable in war when a man's life is at stake, because a horse's life is then a secondary consideration.

Lieut.-Col. Charles Steel: Although I have been cast from the Service, it struck me that you might expect that I should pick up a little information during my term of service which bore upon this subject; and so I would like to make a few remarks, because I want you to feel there is life in the old dog yet. It is curious that Mr. Hunting should have hit upon the leading subject which struck me in regard to the paper, and that is the necessity of having a free hand in the treatment of horses for the purpose of keeping them in health, and, of course, treating them afterwards. I met with one or two glaring instances of extensive injury being produced by neglect of this reasonable license, I was going to say this reasonable treatment of the veterinary department of the army. I will give you one instance very near the place that Mr. Hunting has mentioned, Kandahar. On a march there it was particularly necessary that we should get on very quickly, and in order that we should be supplied with food during the time it was essential to invigorate the transport camels. The officer in command, General Biddulph, ordered a portion of the barley that was given to the horses to be taken away from them and given to the camels in order to invigorate them. I pointed out that the barley would be useless to the camels, and that the horses could not properly spare it, because they were in a wretched state as it was. I do not suppose that any veterinary surgeons in the service or elsewhere have had such an opportunity of seeing the inside of camels as I have had. If I went outside my tent at Quetta there were seventy dead camels round about ready for me to examine before breakfast—there was no lack of material. Invariably when these camels died we found the stomachs full of barley; they had not sufficient bulk of food to induce the intestines to act in passing on the food. They died in reality with their cupboards full. But the General ignored me altogether, and said the order must be carrried out, and the consequence was that the horses were robbed of the small amount of nutriment they had, while at the same time the camels were not invigorated.

Now I will give you a contrast to that ; I will give you an instance of where a free hand was given to me personally. At the Sligo Fair I bought thirty-five horses, and at the same fair some more horses of the same character, three or four year olds, were bought by the 9th Lancers. They were put on the same train, carried on the same boat, and eventually arrived at Aldershot the next morning. The 9th Lancers had the advantage of position, having their barracks on higher ground than ours. I used to be laughed at for my ridiculous ideas with regard to ventilation. We put our horses into stables adapted for holding only fourteen, and they all lived, but we left all the doors and windows open, although it was in October. On the other hand the 9th Lancers took great care of their horses ; they went round to see which way the wind was blowing, and closed the windows to keep the horses nice and warm. The result was that every one of their young horses, bought under exactly the same conditions as ours, was attacked with strangles, while we had not a single case. This is an instance of the benefit of extreme ventilation. With regard to the question of drainage, I had rather a remarkable instance of glanders in that connection. When the troops returned from Egypt in 1883-4 with the Indian troops, there were several mules with them, and they were sent to an island in Bombay harbour, called Butcher's Island, for the sake of isolation. All went on well for a long time, but eventually it seemed to be hopeless to prevent fresh cases of glanders springing up. We then adopted the idea that the whole place was so impregnated with glanders that it was hopeless, and we removed the horses to the Island of Elephanta, and had them divided into parties of six, with power to slaughter any animal that showed symptoms of glanders. At that time—I am not quite sure of my ground here—I did not know that lung lesions preceded the clinical symptoms, so it was an excellent opportunity of watching these cases. We had two parties of six ; one horse in each party which showed symptoms of glanders was destroyed, and in all the other parties glanders was found in the lungs. That is an answer to the question with regard to drainage.

I should like to say that I enjoyed my regimental life very much indeed, and I believe the Veterinary Department is now advancing from the social point of view ; while the establishment of the hospitals and other contrivances and general arrangements which have been mentioned are, in my opinion, calculated to decidedly be of benefit to the Army. Another thing which is inimical to health is sometimes the bad condition of the stables. I remember in one case the horses did not feed with the usual avidity. In going through the stable I said to the officer commanding the troop "There is always a disagreeable

scent when I come into the stable." He said "There always is when you come into it." It was not my presence, because after a short time we had occasion to pull up some of the cobbles with which the stables were paved, and the soil proved to have been so supersaturated with the deposits from the horses that there was this continual effluvium going up. That was only detected by my olfactory powers. The Captain did not appreciate it, but the horses did, because they could not stop in a stable for twenty-three hours out of twenty-four without suffering. The stables were eventually properly paved and the interstices cemented, and the stables have been healthy ever since.

With regard to surra, I see Colonel Hazelton has been kind enough to mention my lamented son and his connection with it. He was engaged in the investigation of it in Burma, and he discovered that it was a bacillus, and named it surra. It was a full dot with a curly tail to it. It is now I believe considered to be not a bacillus, but a protozoa. He was comparing notes with an officer in Bombay, Dr. Carter, who had been investigating relapsing fever, and Dr. Carter produced his characteristic from the human being and my son produced his from the horse, and they were identical, one of the strongest evidences of the truth of the then somewhat recently started germ theory.

Mr. M. Hedley: The title which has been given to this paper admits of another construction to that which has been given to it. "Animal Diseases Following War" might really read as "Animal Diseases During War" so far as the discussion this afternoon has gone. Animal diseases following war might be taken to mean the diseases which are distributed after the war is over and the horses are taken home. During the course of the distribution of the horses, there is great responsibility thrown on the shoulders of someone. When horses were purchased recently in America with the intention of being used in South Africa, and the war was discontinued, they were not delivered in South Africa but were taken elsewhere. That elsewhere was the United Kingdom, and the United Kingdom suffered seriously for it. The disease that followed the war in that case was glanders. On another occasion horses were brought back again from South Africa, and the disease that followed the war in that case was epizootic lymphangitis. In the list which Colonel Hazelton has brought under our notice, I would like to ask how many of the diseases which follow war, and which might be distributed in our islands, can be avoided. In what way should they be dealt with so as to entirely avoid them? Can that be done by the Army Veterinary Corps? Is it frustrated by the interference of somebody else? If by somebody else, who is it, and what is the best way to deal with them?

Mr. R. Rutherford: In the first paragraph of the paper Col. Hazelton says that diseases occurring on board ship, accidents which occur during embarkation and debarkation, must all be considered. I have gone carefully through the paper, and this being a subject in which, owing to old professional experience, I am very much interested, I hoped to be able to learn whether the management of horses on board ship and during embarcation and debarcation was any better than it was thirty-five years ago when I had charge of it in the Colonies. I am disappointed that Col. Hazelton has said nothing about that subject. I will only remark that, as a rule, there were only two things which caused loss of life in those days, namely, broken legs from rough handling in slinging the horses or walking the horses on board, and drowning. In my early days every horse was slung on board. Then with regard to the diseases (and here comes in a question which, I think it is a pity Col. Hazelton has neglected to say anything at all about) the diseases of my early days were, I can honestly say, due almost entirely to what Col. Steel called want of ventilation. I have seen instances, over and over again, where, owing to want of ventilation in the carriage of horses, the mortality amounted to seldom less than 20 per cent., and was frequently as high as 40 per cent., on a voyage which in those days usually lasted on an average sixty days, entirely due to want of ventilation, selection of bad ships, giving the horses insufficient standing room, not giving them proper material to stand upon, and a bad system of watering and feeding. I think it is a pity that the subject has not been gone into more fully by Col. Hazelton.

Further on he says we have to consider the different species of animals used in war in relation to disease. I go a step further than that. I pointed out in a paper which I read at a Society such as this some years ago, when I came home on leave, that it was important that no horses should be shipped to a country that did not more or less resemble the horses of the country they were shipped to. It is no use shipping big, underbred horses to India; they will not stand the climate. I recollect one of the first duties I performed, after the suppression of the Mutiny, was to proceed to a station some sixteen miles from Calcutta for the purpose of ascertaining the cause of so many horses being unfit to work. There was no veterinary surgeon there, although there were several regiments of cavalry at the place. The horses were tied up in bunches under the trees, and many of them were glandered, and nothing was being done for them at all. The rest were absolutely unfit, and scarcely able to drag their legs after them, simply because they had been badly purchased; they were not bred to stand the climate of India. I say again that,

beyond doubt, in purchasing and shipping horses too much attention cannot be paid to the country where they are to be shipped to, and the requirements of the country so far as the horses are concerned. There should be a near resemblance between the horses of the country and the horses sent to the country if you expect them to stand the climate and the diseases of that country.

Lieut.-Col. Hazleton, in reply, said: I am afraid this discussion has not taken the course I thought it would. I thought Major Eassie's remarks were very apposite to the subject. They included the preparation of horses for war and also the diseases of horses during war. I did not intend that this paper should be confined to the diseases of horses following war only: I thought diseases occurring during the war would be considered to apply under this heading. Of course the diseases of animals of a communicable nature occurring during a war are those which will most probably follow the war, as in fact they always do. That pertains in the case of glanders, epizootic lymphangitis, surra, biliary fever, and other diseases which might be mentioned. Major Eassie's arrangement for the care of remounts does not need any words of mine to recommend it. He has proved to me quite plainly, from his own experience in Africa, that this system works equally well in the field as it appears to be suitable when explained by Major Eassie himself. He has shown me the remarks of officers in the Remount Department who are familiar with the working of depôts and veterinary hospitals under this scheme, and they are most flattering. The scheme can be easily applied to a veterinary hospital during war time, and also after the cessation of operations in an enemy's country. If this scheme were attached to a veterinary hospital, it would be a great advantage to the animals using that veterinary hospital; of that I am quite satisfied. Major Eassie rather exceeded the time allowance, I think, in talking of his invention, because he also has considerable experience of the diseases, which I touched upon in this outline of a paper, during the actual conditions of warfare in South Africa. As I said in this paper, I was not in South Africa, but Major Eassie was present during all the operations, being there before the war started and coming home after its discontinuance. I am therefore very sorry that he was not insistent enough to make some remarks on animal diseases during war time and following war, because it would have borne more particularly on what I have said in my paper than the line the discussion actually took. I am a little deaf, and when Mr. Hedley threw his questions at me in such a rapid manner I missed three-parts of them. I asked him to write

them down, but he has not done so, but I think, from what I jotted down, he wished to know how many of these diseases could be distributed to other countries after the war. I think the sum total comprises glanders, mange, rinderpest, epizootic lymphangitis, surra, n'gana, biliary fever, epizootic aphtha, and probably specific epithelioma. He also asked me the question as to how we were to deal with these diseases after war in other countries. Really that is a question which it is somewhat difficult to answer, because the greatest minds in our profession have vainly tried to answer it, and it is unanswered at the present day. I may have my own views, but what are they compared with the views of men like Hunting, and other men of eminence in our profession? and even they do not know the answer to that question, neither do the eminent authorities on the Continent. Professor Nocard has distinctly said so, and has also said it is the greatest problem of modern times in animal sanitation to prevent the spread of these diseases from one country to another. I forget the rest of the questions asked me by Mr. Hedley, and I shall be very much obliged if he will tell me them so that I may answer them.

Mr. Hedley: The other question I asked was whether it was possible to avert the introduction or these diseases into the British Colonies—I was not referring to any other countries than those. I further asked, Was it due to the interference of some department, other than the Veterinary Department or the Veterinary Corps, if disease was introduced in that way: was it against the will of the Veterinary Service, and if so who was to be blamed, and how could we deal with them?

Lieut.-Col. Hazelton: I am afraid I cannot answer that, in fact I will not try to answer it. (Hear, hear.) Col. Steel speaks with a long experience of the treatment and management of disease in horses in the Army. Ideas on disease have have somewhat changed since Col. Steel's time, but he asked one question which I think I may answer in the affirmative, and that is that glanders may be detected in the soil, and it is just as necessary to disinfect the standings from which cases of glanders have been removed as it is to do anything else.

Mr. Rutherford said that I was rather remiss in not including the diseases of animals on board ship in this paper. I thought that I would not do so, and I thought I made that plain in the paper when I said "These must all be considered," but I thought the principal diseases to be considered were those communicable diseases of animals following war. Had I made any remarks about diseases connected with horses on board ship they would really have been confined to the communicable diseases of animals, the diseases caused by bad ventilation and probably

by accidental injury. The diseases caused by overcrowding and bad ventilation on board ship are those which affect the respiratory apparatus and diseases of an apoplectic nature. Years ago the mortality from diseases on board ship during transit by sea was considerable ; as Mr. Rutherford said, between 30 and 40 per cent. of casualities often occurred. Under the conditions which obtain at the present time, under the regulations which have been laid down for the fitting up of horse transports, ventilation is assured. The animals are tied up securely, although they are not quite close enough I think, but in that way the mortality has been reduced, speaking without the book, from 30 or 40 per cent., as Mr. Rutherford said, to 4 and 5 per cent. nowadays. (Hear, hear.) I have been with horses on board ship, and I have known a great number of my officers who have spent many days on board ship with horses. It is a very arduous and trying time, at the same time it is one of the most interesting experiences a veterinary officer can go through. Every transport nowadays which leaves England, unless it leaves under condition of a very emergent nature—and even then we do everything possible—is inspected by one of our officers, and if there is any fault to be found he is bound to bring it to light, and in my experience that is done. Of course the comfort of horses on board ship is a subject which has lately been studied much more than it used to be, because unless horses arrive fairly healthy for service at the port of debarkation, as Major Eassie pointed out, they are absolutely useless.

Another point of interest that Mr. Rutherford made was the necessity of proper horses being sent to a particular country. He made the remark that horses supplied for war in a particular country should resemble the indigenous horses as far as possible. That is very sound teaching. The horses of the country are best to use in that country ; it is a question of evolution. The heavy, underbred horse is useless in India, as he pointed out, and I fancy that the light, well-bred horse of India would be equally unsuitable to the heavy country met with in the West, in the temperate climes of England or Europe. Gentlemen, I beg to thank you very much indeed for your patient hearing.

SECOND DAY.

Thursday, July 26th, 1906.

Mr. M. HEDLEY, Vice-President, in the Chair.

The CHAIRMAN: The following notice of motion has been sent in; there can be no discussion on it. You must either accept it or reject it: "That this meeting of the National Veterinary Association renews its decision that contagious abortion in our domesticated animals should be scheduled as a contagious disease by the Board of Agriculture."

Mr. J. CAMERON: I beg to move that.

Mr. A. I. MACCALLUM: I second that.

A MEMBER: I beg to propose that the resolution be not passed.

The CHAIRMAN: That is not a proposition, it is simply a negative. You must vote against the resolution.

The resolution was then put and carried, 23 voting for and 9 against.

Prof. A. E. METTAM: I beg to propose that that resolution be brought under the notice of the authorities.

Mr. A. SPREULL: I second that.

The CHAIRMAN: It is almost unnecessary to put the proposition, because if any attention is to be paid to the resolution it will have to be brought under the notice of the authorities.

The resolution was then put and carried.

PUBLIC HEALTH AND VETERINARY SCIENCE,

By Professor Boyce, M.B., F.R.S., The University, Liverpool.

The discussion of the question of the relationship of the Veterinary Surgeon to Public Health comes at a remarkably opportune time. The subject is indeed one which during the last few weeks has become a matter of very general public concern.

Following shortly upon the publication of a remarkable book, "The Jungle," by Mr. Sinclair, the state of affairs described by the Special Commission appointed by the President of the United States disclosed a very unsatisfactory state of affairs in the great meat packing houses of the United States. As is the custom in the United States very strong public feeling was at once aroused and legislation has been invoked to place the meat industries under a far more rigid and skilled control. In the mean time there have been in consequence immense losses in the preserved meat trades which have not been confined to the United States but have even spread to this and other countries.

I believe, however, as far as the United States is concerned that a very through putting in order of the house will be effected by the disclosures, and that the meat packing industries will again establish themselves in public favour. I have had some experience of the Federal Sanitary supervision exercised from Washington, and I feel confident that the very skilled heads who there direct the Public Health and Agricultural Bureaus will, if they are endowed with the proper powers, leave no stone unturned to bring about a thoroughly efficient sanitary control of the meat trade. The Bureaus of Public Health and of the Animal Industries have already on numerous important occasions proved their great practical value to the United States in protecting the public health, in rendering the food supply purer and helping in numerous ways by their skilled advice and watchfulness many of the great industries of that country. In these respects Washington stands in the first rank, and the great assistance which the Bureaus continually render to commerce might especially with advantage be noted by this country with a view of our adopting similarly comprehensive scientific organisations. How important efficient sanitary supervision is to the general welfare of the country is seen not only by what has already been accomplished in the United States with its system of numerous separate State Governments, but also by what has been effected in Germany, Denmark and other countries. The German meat industries have

not suffered through what must have been at first felt as a very rigid and exacting system of inspection. On the contrary the waste in the meat trade in that country has been diminished and the public has gained a pure meat supply. One cannot but admire a nation which following the advice of the great pathologist, Virchow, brought about a complete reform in the pork trade and established it upon a firmer basis than ever before, and also which tries to meet every fresh exigency—which may diminish the reputation of its pure meat supply, even when the supply of meat, as for example at the present time, has become somewhat scanty,—by new scientific methods placed in the hands of its inspecting veterinary surgeons. In Denmark supervision of the milk trade has materially improved the commercial prospects of that country.

In England, the action of the Local Government Board, backed up by strong public sentiment has already brought about a great reform in a very important and extensive trade, that of the oyster industry. The merchants have begun to see that it was to their interest to furnish a pure supply to the public and that they must skilfully supervise their fattening grounds. Already much organised reform has taken place, and I am informed that this year the state of the oyster industry is exceedingly good and in marked contrast to that in the potted and tinned food trades.

Every trade resists more or less what it deems interference, but with the spread of skilled knowledge, resistance along certain lines becomes less; it becomes less necessary for legislation to forcibly bring about reform; the trade itself in many instances takes the initiative as soon as it has been made authoratively acquainted with the facts. I know of instances of this, and especially of an example of special interest to this discussion, where the cowkeepers have co-operated with the Health Authority and have established an efficient veterinary supervision of their animals.

The Chicago tinned meat reports, the international movement for the prevention of tuberculosis, the increasing demand for a purer food supply, the injury which is done to the animal industries by the ravages of disease, the retardation of our progress in tropical countries through want of animals, all conduce to raise the question of the position of the veterinary surgeon to the first rank in economic importance. There is no longer any question that veterinary science can render an immense help to owners of the ever increasing cattle breeding stations throughout the world. Pasteur very many years ago showed what could be done in this respect in France. Theobald Smith, working for the Bureau of Animal Industries, demonstrated the method of diminishing and stamping out Texas Fever. Bang on the one hand, by adopting general sanitary measures among the cattle in Denmark, and Behring on the other hand, still more recently by means of vaccination, are combating the spread of tuberculosis in cattle. The condition verging on bankruptcy which the Mauritians experienced a few years ago as

the result of an epidemic of Surra, the losses to the Indian Transport Service by the ravages of Surra and Dourine, the perpetual fear of the spread of cattle plague in Egypt, a condition which, perhaps, more than any other factor would paralyse the phenomenal prosperity of that country, the necessity for fresh milk and animal food in many of our tropical possessions, the want of which now renders prolonged residence almost impossible, the equal necessity in these countries of cattle and horses for transport purpose should, as Nocard pointed out, shortly before his death, to the citizens of Liverpool, bring home to traders, agriculturists, and Governments the necessity of a far greater supply of skilled veterinary assistance than exists at present. It is with gratification that one is enabled to record that there does appear to exist an evident desire on the part of merchants and Governments to make greater use of the veterinary surgeon. The owners of Estancias have taken skilled veterinary advice, and administrations in Egypt, India, and the Colonies are deriving increased profit by the more extensive employment of veterinary medical men. What is more striking of the increased activity in this direction, than the fact that a Journal of Tropical Veterinary Science has recently been published in India by Messrs. Pease, Baldrey and Montgomery? There, however, still remains abundant room for the employment of the properly trained veterinary surgeon in India, the West Indies and West and Central Africa, and perhaps now that the success of medical science in the preservation of health, and of botanical and chemical science to the growing of cotton and rubber has been demonstrated upon a most extensive scale throughout our tropical empire, we may look forward to the far greater employment of veterinary science to further extend commerce in these possessions. That great changes can be brought about in these countries is evident. Just as Sierra Leone is no longer regarded as the white man's grave, and as the health generally throughout West Africa has been greatly improved owing to systematic medical effort, so there appears every reason to believe that it is possible to introduce and to maintain domesticated animals in countries in which it has hitherto been regarded as impossible.

The time has come when there should be no haphazard introduction of animals. Careful investigations should be made beforehand by competent veterinary men, not only of the diseases of domesticated and wild animals indigenous to the district and communicable to freshly introduced animals, but also of the animals introduced and kept under observation after having been exposed to infection in other districts.

The national importance of fully equipped veterinary surgeons in the Army has begun to be recognised, and the War Office has taken the important step of encouraging post graduate work in veterinary medicine, just as the Colonial Office has insisted upon it in the case of medical men seeking posts in the Crown Colonies.

There can be little doubt that the nation must have sustained very considerable losses in the recent war in South Africa owing to the want of sufficient veterinary officers, such losses should be obviated in the future.

Following on the progress made in bacteriological science a very large number of medical men have been employed in Europe, the United States and in this country upon the practical application of bacterial products and sera to the prevention of disease. To a very large degree this aspect of medical science has been monopolised by medical men even when the vaccines were destined for animals. It is a misfortune that hitherto, at any rate in this country, so little opportunity was available for the study of preventive and curative sera and vaccines amongst the veterinary profession.

Surely it is time that this subject should engage the attention of the veterinary schools, and that those in authority should seek the financial support which would render this possible. Many years ago the work of the medical school was confined solely to training for the profession, and whilst it was so confined to training students for a career, it received little external aid. The adoption of medical research as an equally important function of the medical school, and the increase in consequence of the usefulness of these institutions to the nation, has had the effect of bringing in outside aid. A far more energetic effort should be made by the veterinary profession to capture many of the posts which now, almost as a matter of routine, fall to medical men. The way to capture them is to be equipped.

In relation to the public health of this country the veterinary surgeon should occupy a far more prominent position than he does at present. It took a considerable time before Municipalities and District Councils saw the importance of engaging the whole services of medical men to supervise the health of the people; we are not even yet perfect in this respect but a vast improvement has been made, and the death rate in great towns has been greatly diminished. There has been a corresponding saving on many sides in municipal expenditure and the expenses of the medical department has been amply repaid. By strict medical supervision and the preventing of epidemics, the growth and expansion of larger towns have been able to take place without risk of the epidemics which would have inevitably occurred in past decades. To qualify for the posts of Medical Officers, the medical men organised a special training, and now a large proportion of the medical officers of health have obtained the Diploma of Public Health granted by a number of medical bodies. The work of the Medical Officer is now very complex; analysts and numerous inspectors have been given him, and in some cases he is furnished with the services of a veterinary surgeon. Enough, however, has not been done in this direction. It has been assumed that the Medical Officer could equally well supervise the meat and milk supply of the district as well as attend to the health of the community. There is no doubt that the Medical Officer is best

qualified from his position to judge of the ill-effects on man of diseased meat, unsound food of any kind, and contaminated milk, but his hands, in my judgment, are immensely strengthened if he has an expert who, like the Public Analyst in his own sphere, is able to give an authorative opinion upon the meat or the milk or the contents of a tin of meat. At the present time there are not sufficient veterinary officers attached to Health Departments. I am of opinion that one way in which a demand for these very necessary experts might be created, would be by giving more attention to the public health side of the veterinary surgeon's training. Public opinion has, of course, to be educated, but let the veterinary profession take their part and make ready for a change which we consider inevitable in the interests of public health. No one should be better qualified than the veterinary surgeon to pronounce an opinion upon the soundness or otherwise of a carcase or piece of meat or the fitness of an animal to provide milk. He should be the authority to decide upon the hygienic condition in which the animals are to be housed, slaughtered, and eventually disposed of.

There can be no question of the advantage of a trained veterinary surgeon as meat inspector. During a period of four or five years he has devoted himself to the study of animals in health and disease. That a less specially qualified officer should be chosen for the position of meat inspector appears to me to be not in the best interests of the public health.

The relation of the veterinary surgeon to the animal industries of the country are obviously important, since he has to be relied upon to prevent the spread of disease in this counrry and prevent its introduction. I am of opinion that they would be rendered still more useful and would still further demonstrate the great services which they render the community if their duties as inspectors were strengthened by providing them with facilities for research into the infectious diseases which they have to observe

The part which the veterinary surgeon is called upon to take in the interests of public health is an increasingly important one. New openings will inevitably be created both at home and abroad, and it is the duty of all those interested in the profession to educate the public to recognise the profession's importance in public health matters, and to train and prepare the veterinary surgeon for the part which he should properly take.

Discussion.

Mr. T. Eaton Jones, in opening the discussion said: In the first place I must thank Professor Boyce for his most excellent paper, which I am sure has been most interesting to us all. Prof. Boyce, as mentioned yesterday by the Vice-Chancellor, was the moving force in the establishment of a veterinary school in Liverpool, and as a medical man and as one of the leading scientific men in the world, his help in the advancement of veterinary science in connection with public health will be of inestimable benefit to our profession. He has one great fault, and I regret to say that I am afraid it would be too great a sacrifice for him to remedy it now; he does not possess the five letters M.R.C.V.S. Nevertheless he has been, and I sincerely hope always will be, a sincere well-wisher of all of us, and by the influence at his command, and by his untiring energy, a great deal might be done to place us side by side with the medical profession in matters relating to public health. Concerning the duties which the veterinary surgeon performs in relation to the public health of various towns and cities, I think the Professor might have gone more deeply into the working details, and submitted from a medical point of view a scheme that would allow of our profession being associated much more intimately than it has been in the past with the working of national and municipal affairs. There can be no doubt, in any of our minds that, up to the present, the veterinary profession has taken far too small a part in imperial and municipal work. The reasons of this are, in my opinion, not far to seek.

In the first place, the veterinary profession is composed of a comparatively small number in contrast with the sister professions of the law, medicine, engineering, etc., and consequently, by some means or other, the principle and practice of veterinary medicine and surgery, and interest in municipal affairs do not as yet seem to have gone hand-in-hand. Again, in years gone by, our profession has been too much inclined to confine itself to private practice, and the teaching at our colleges has been to that end. Such a thing as preventive medicine and public health work has been until recently kept out of the student's curriculum. It is quite a rare thing to find a veterinary surgeon a member of a city, town, or urban district council, and of course as we all know there is no member of the profession that, up to the present, has interested himself to any great extent in the imperial affairs of the nation. So long as these conditions exist, I consider it a matter of difficulty for any great strides to be made, as, should opposition be encountered to proposals that would be of immense benefit to the veterinary profession, there is no one at hand to uphold us or look after our interests, and therefore there is very little chance of any such proposals being made law. As an instance of what might be done by men who

interest themselves in public life, I believe that I am perfectly right in saying that, through one veterinary surgeon being a member of a very large public body, the meat inspection of that city was placed upon an exceedingly satisfactory footing, and is now carried out under veterinary and medical supervision. Why? Not because the gentleman who brought forward the proposal was a veterinary surgeon, but owing to the fact that he was a member of the Board, and his ideas were placed before that body in a lucid manner, consequently his colleagues were satisfied that it was a just, right, and proper thing to do. If one man associated with a large public body interested in public health can do so much, and most of our large towns possess veterinary surgeons, they, by following his example, could be of immense benefit to the profession throughout the country.

Concerning the recent scandals which have been exposed with regard to American tainted meats, I fail to see that it interests to a great extent the veterinary profession of this country. We, as veterinary surgeons, are no doubt the only properly qualified persons to inspect animals prior to slaughter, and in my opinion we should also be authorised to supervise the inspection of meat in abattoirs and, (in conjunction with the Medical Officer of Health) be responsible for its soundness. By this I do not mean to say that nobody but a Veterinary surgeon should be a Meat inspector, as it would not be a dignified attidude for the professional men to take up, walking from shop to shop inspecting the condition of meat contained therein. And the qualified meat inspector as he exists in certain large towns in the Kingdom, after passing an examination in sanitary science which embraces meat inspection, is quite competent to judge as to the soundness or otherwise of meat after it has been placed upon the market. Again, with regard to the examination of tinned meats, no doubt the veterinary surgeon is quite capable of undertaking a task of this kind, but I feel sure the majority of those present are of opinion it would be usurping the public analyst's position were such a method of procedure adopted.

Professor Boyce mentions the federal sanitary control exercised from Washington, U.S.A, and the skilled heads who control the public health and agricultural bureaus, and it would be interesting to know if any of these gentlemen are qualified veterinary surgeons, and in what way they are appointed and act. If such immense good is being done by these Bureaus in America, is it not possible to have them established in this country on somewhat similar lines? Then again, what has been done by Germany, Denmark and other European nations it is quite possible for us to do, but it would be interesting to know if the measures are in the hands of veterinary surgeons, and on what lines. For instance, the Local Government Board has no doubt brought about a very great improvement in the oyster industry, and as an oyster forms a part—although extremely

small—of the food of this nation, it is right that it should be looked into and it shows that the Local Government Board are progressing in the right direction, but I fail to see in this the part played by a veterinary surgeon or what influence he had in bringing about an improvement.

Concerning the general inspection of cattle throughout the country, there can be no doubt that each town or district should have its own specially appointed veterinary surgeon to examine all milch cows. The danger arising from the consumption of tuberculous milk must be patent to everybody, especially now that tuberculosis of the udder has been scheduled as a disease by the Board of Agriculture. A systematic inspection of cattle by veterinary surgeons (acting in conjunction with the Medical Officer of Health), would lead to immensely improved conditions of human life, especially the lives of infants throughout the country, and the local authorities would be amply repaid for the small cost incurred in the working of such a scheme. For this purpose, tuberculosis of the udder should be made a contagious disease, with powers of compulsory slaughter and subsequent compensation by the various authorities, and on this matter advice would have to be sought from the Board of Agriculture, who would no doubt consult the Chief Veterinary Officer attached to the Board.

Touching another branch of our food supply and one which is, in my opinion, of extreme importance, namely, the poultry rearing industry. Should not some inspection of our poultry yards and markets be instituted, knowing as we do the susceptibility of fowls to tubercular and other diseases? We must also remember that fowls form a large proportion of the food of invalids.

I find Prof. Boyce has not alluded at all in his paper to the administration of the Contagious Diseases Animals Act, and the great danger arising to the public from diseases included in the Act, such as glanders, anthrax and rabies; the two former diseases being responsible for a very great number of deaths throughout the country. I am aware that most towns have a veterinary inspector, but again the powers vested in the inspector by the Board of Agriculture are not sufficiently comprehensive, nor the mode of administration of the various Acts relative to these diseases left sufficiently in the hands of the profession, which from every sensible point of view must be warranted to control them. Further, the question of the management of horses owned by public bodies and performing the cleansing operations of towns and cities, which are intimately related with public health, has found no place in the Professor's thoughts, and as there was not long ago a discussion over the conditions of the Cardiff appointment, I thought it a fitting opportunity to bring the question forward as to what steps should be taken to make such an appointment impossible for the future.

As regards tropical veterinary science, I am afraid I am not

sufficiently conversant with the subject to deal with it, but we have always veterinary surgeons who may be found willing and capable of taking up appointments in tropical countries.

There is no doubt at all that the best thing that could possibly happen to the veterinary profession would be the appointment of a Veterinary Officer of Health. This appointment would not clash or in any way interfere with the duties of the Medical Officer of Health, in fact the duties of each are so intimately related that they should run hand in hand, and I have no doubt in a great number of cases the Medical Officer of Health would be considerably relieved to have a Veterinary Officer of Health acting in conjunction with him, and relieving him of some of the difficulties he would no doubt experience when there is no one to help him. Under a Veterinary Officer of Health, veterinary inspectors would be appointed who would take charge of the health and conditions under which the animals live in his district, and the Veterinary Officer of Health would report with the Medical Officer of Health to the authorities on any subject likely to be inimical to the health of the community at large, leaving such matters as the examination of milk, analysis of milk, inspection of tainted meat, fish and other matters to the public analysts, fish inspectors, and other qualified officials.

I should like to add, in conclusion, that an exceedingly happy relationship has always existed between myself and the other officials of the Health Department of the City of Liverpool. The Health Department of the City of Liverpool is composed of four departments, each presided over by a separate head, and working quite in harmony one with the other. No friction of any sort has occurred during my term of office, and I sincerely hope it never will do so. We have a Medical Officer of Health's Department, a City Engineer's Department, a Building and Surveyor's Department, and the Veterinary Department; and, as I have already said, I have been extremely happy during the eleven years I have been with the Corporation, and never had the slightest trouble or friction of any sort whatever with the Medical Officer of Health (Cheers).

Mr. A. I. MacCallum: I wish to say a few words upon this excellent paper on "Public Health and Veterinary Science" by Prof. Boyce. I am not learned, and if I say anything out of place you will excuse me. We have a saying in our country that "What is not ill said is not ill meant." My difficulty is this, as to why the veterinary profession has not attained its proper position in the society of scientific men. My difficulty is not what they have attained, but what they have done; my difficulty is that they are here at all. We have no place in ancient history. We were only incorporated sixty-two years ago, and, as far as I can judge, it humbly appears to me that we have pioneers in our profession who have done excellent work for the profession, and to whom we are indebted for a great deal of the success we have now attained. With regard to the difficulties that we have laboured under, it seems to

me that the Government of the country has never done anything for the veterinary profession until lately. They have certainly given £20,000 to Ireland for veterinary education, and they have given a promise, I understand, of £800 to the London School. We have veterinary schools or colleges in Scotland, and they have been in existence for a long time. They have educated and sent out into the world about five thousand thoroughly equipped veterinarians; and what support have they received from the Government for purposes of research work and for the purpose of raising the status of our profession? Not a brass farthing! It seems to me that that is not right. (Hear, hear). We are in the hope that very shortly we may get a Government grant, and we hope to put it to good use for the raising of veterinary education in our country and throughout the world. If we do not get it, we will have to exercise a little self-denial and do what we can to raise our profession as well as in our power lies; but we are hopeful that there will be a change soon.

Then there is another little hardship we have to endure. I notice the following words on page 102 of Prof. Boyce's paper: "Following on the progress made in bacteriological science a very large number of medical men have been employed in Europe, the United States and in this country upon the practical application of bacterial products and sera to the prevention of diseases. To a very large degree this aspect of medical science has been monopolised by medical men, even when the vaccines were destined for animals. It is a misfortune that hitherto, at any rate in this country, so little opportunity was available for the study of preventive and curative sera and vaccines amongst the veterinary profession."

That, it seems to me, is another great hardship, that the medical profession should rob us of our bread—(Cheers.)—that they should hold positions which can only be suitably filled by qualified veterinarians I may tell you that I am hopeful that very shortly we shall make the medical profession "sit up." The students who come to us next October will be required to pass the same matriculation examination as the medical students. The curriculum to which these veterinary students will be asked to attend will give them a position not inferior in any way, but superior to the medical curriculum; and after they have received the diploma of the Royal College of Veterinary Surgeons they will be asked to take a post-graduate course and present themselves at an examination for Master of Surgery and Bachelor of Veterinary Medicine. After they have done some practical work for a year or two they will present themselves again, and by submitting themselves to a practical examination they will obtain a Degree of Doctor of Veterinary Medicine. I think that is a thing we have been aiming at for a very long time, and I am hopeful that it will very shortly be accomplished. (Cheers).

A little further down on the same page Prof. Boyce says: "A far

more energetic effort should be made by the veterinary profession to capture many of the posts which now, almost as a matter of routine, fall to medical men." Gentlemen, how are we to capture them? The way to capture them is to be equipped. Will anyone in this room rise and tell me to my face that M'Fadyean is not equipped, that Mettam is not equipped, that Dewar and Bradley and James McCall are not equipped, that Smith of Toronto is not equipped, that the McEachrans are not equipped? Or, to come home to our own country and to pick from the rank and file of the profession, will any man stand up in this meeting and tell me that Stockman is not equipped and that Hunting is not equipped? (Cheers). I could name a long list of other men who we consider are perfectly equipped and who need no further equipment. I know, and you know, that we are not perfect, but you cannot point to any other faculty that is perfect. You know that a minister once said to his people "You cannot point to any faculty that is perfect; you cannot point to any individual that is perfect," but a poor woman with her sore heart rose up in the meeting, and he said to her, "Well, my poor woman, do you know anybody that is perfect?" "Yes, Sir," she said, "My man's first wife." (Laughter). The first wife in our case, gentlemen, is the medical faculty, and I think I have said enough to convince you about them. (Cheers).

Virtue finds its own reward and vice its own punishment. What is our little vice? Perhaps I could tell you better what our little vice is by telling a story. Many years ago I went for a holiday, and one morning at Calcutta, having nothing to do, I dropped into a training college. I heard a gentleman address the Hindoo students, and among other things he said, "You fellows that have brown faces, the thing that we deplore in regard to you is your physique. You know what that is, that is uprightness; you know what that is, that is straightforwardness. In the country we come from we pride ourselves on the transparency of our character." I thought it was very good of the gentleman to say that. A few years afterwards one of the students of that college came to our country to study medicine, and he sought out this friend and reminded him of the unkind thing that he had said. The gentleman replied: "What do you think our little weakness is in this country?" and he said "If I may be allowed to express my opinion without giving offence in any way, I would say it was conceit." Now, gentlemen, you want an example of what our little conceit is. During the past year we had a horse case tried; we had more than half-a-dozen eminent veterinary surgeons going into the box and kissing the book, and declaring the horse had spavins on both hocks. A short time afterwards several equally eminent men went into the witness box and kissed the book, and said the horse had no spavins at all; it only had rough hocks. That, gentlemen, is our little conceit; and I hope the time is not far distant when it will be impossible to make such an exhibition of professional ability. We

had in our country an eminent lawyer who sat on the bench and administered the law, and he was second to no man that I ever knew. He had an opinion as to professional witnesses, and do you know what it was? He said they were liars, and damned liars; he also said that scientific men in the witness box could be got to say anything if you made the fee high enough. I hope that is not true of veterinary surgeons; and I hope the time is not far distant, as I have said, when we will not be able to make such an exhibition of ourselves.

"Then let us pray that come it may—
As come it will for a' that—
That sense and worth, o'er a' the earth,
May bear the gree, and a' that,
For a' that; and a' that,
It's comin' yet for a' that,
That man to man, the world o'er,
Shall brothers be for a' that!"

Mr. J. CAMERON: I beg to thank Professor Boyce very much for the paper which he has given us. I do not intend to deal with it very fully because there is not a great deal that one can find fault with; but I consider there are one or two points in this paper which are quite sufficient to lead to a day's criticism and discussion. There are many texts in scripture on which a great many sermons have been preached, but there is very little similarity between them. My friend Mr. MacCallum has taken my text, and therefore you will have to excuse me if I take the same words as the subject of my remarks. The text is a very short but a very important one, and if the Professor had done nothing else but give us this one short sentence the paper would have been amply justified. The sentence is as follows: "The way to capture them is to be equipped." There is no need for me to go over the ground that Mr. MacCallum has already travelled over, but the first head of my subject would be that "Providence helps those who help themselves."

To my way of thinking, there are two aspects from which we may look at the subject. In the first place the means have to be provided whereby those who want to be equipped can obtain the knowledge and the practice which is necessary for their equipment. We have an instance here in Liverpool, where it seems as if large sums of money have been given to the University. I suppose some part of that money has been pooled, and the trustees have set aside a certain amount of it for the development of veterinary education. We have another noble illustration of that in the case of our friend, Mr. MacCallum. Then in the second place, the student, the person who is to be equipped, requires the ways and means. The stock from which the veterinary profession has been drawn in the past has been largely of a comparatively poor origin, so far as money matters are concerned; and in many cases a student, by economy, frugality

and perseverance has become a veterinary surgeon. But what chance is there for him being further equipped? I quite agree, as I said here last year, that

"Our vets. M'Fadyean, Stockman, Bowhill
Can race the doctors all uphill."

I quite agree with that still; but we require a greater number of men to be equipped. We cannot spare any of the men that I have mentioned to fill up positions which should be occupied by veterinary surgeons, because they are already filling important positions. It should be our aim and object to educate and equip the present students to the highest degree.

In a great many professions there are a large number of Bursaries and Scholarships by means of which the energetic young men of the profession are further educated and developed; ways and means are found whereby they can continue their studies; but in the veterinary profession there are very few of such scholarships. Some of our colleges grant a free scholarship to certain students. That is a great incentive to them to go on, but we require further development on those lines. For instance, it is not at all satisfactory that the Jubilee Bursary should have to lie in abeyance for three years before sufficient money is obtained to send a student away for a year's education. The point I wish to urge is that the profession requires means whereby its students can be further educated and developed.

Prof. A. E. METTAM: I am sure we are all very much indebted to Professor Boyce for introducing to us the subject of "Public Health and Veterinary Science." I think we are greatly indebted to the Author for bringing this subject into prominence. It is time that the public recognised the veterinary profession, and recognised it in this sense, that it is one of the most important safeguards of the public health. When we consider the large number of animals that are being prepared for food, and when we consider the secretions of these animals that are used either in the raw state or prepared in certain ways for human food, and when we consider the training of veterinary sergeons at the present moment, inefficient as it may be (although I maintain that it is not far short of the best that is given in any of the medical schools)—inefficient as it may be, still that education, that training of the veterinary surgeon is not taken full advantage of. I think that in this paper of Professor Boyce's, who is a prominent scientific man, a trainer and a teacher of medical men, Professor Boyce has been impressed with the necessity of a further use of the veterinarian; and I think we must take this flattering unction to ourselves, that at least one man in the United Kingdom has recognised the ability of the veterinarian. Of course I do not suppose that, even in this magnificent University of Liverpool, where they have a vast amount of money, they are equipped to the same extent as they would wish. I do not know that there is any perfect human Institution, but I believe we are all trying to get as near per-

fection as it is possible to be. And surely there is no man breathing, whose opinion is worth anything, who will not admit that of all professions, the last generation has seen the greatest advance in the veterinary profession. What were our forefathers in the profession of fifty years ago compared to the members of the present generation—I mean as regards their scientific attainments? We know that there were giants who have gone before us; we know that in the middle of the last century there were men whose powers of acumen, and of foresight, and of seeing through things astound us, even at the present time, when we read the old clinical records in the back numbers of *The Veterinarian.* There were giants in those days; let us hope there are giants at the present day. But I maintain that the file of the profession has been raised to a much higher level than it ever occupied in the middle of the last century. Further, I maintain that during the last ten years, the advance in the teaching, the preparation and equipment of the veterinary student to fight the battle of life has advanced greater in proportion than that of the students of any other science. Probably that is due to the fact that we have had good friends behind us, that a number of gentlemen taking an interest in the various veterinary schools have endeavoured to improve the teaching of the veterinary schools.

I will give an illustration of the strides made by the veterinary profession. The veterinary profession have endeavoured to teach their students upon medical lines—I grant all that—but nevertheless we must admit that the veterinary student at the present time, when he leaves his college armed with his diploma, occupies a vastly improved position as compared to that of his antecedents of twenty or thirty years ago. Then with regard to the matter of public health, take the question of milk and meat inspection. I am one of those who believe that this should be solely in the hands of the veterinary surgeon. I do not mean to say that the veterinary surgeon should do the drudgery of the work, but I do maintain that a properly qualified veterinary surgeon should be the ultimate court to which these questions are assigned when his lay inspectors, if you like to employ such men, have come across something which they have been led to suspect is not food suitable for man. Some time ago, indeed not a month ago, I was present at a meeting of medical men and veterinary men in the Veterinary Section of the Sanitary Congress; and at that meeting a sanitary officer with no training, that is to say no veterinary or medical training, but a man who held a diploma of one of the sanitary institutes, got up in the meeting and said it had been his painful duty a week before to condemn swine suffering from tuberculosis belonging to a veterinary surgeon. I think of all the appalling things I have ever heard that was the worst of all. Here is a sanitary inspector who goes and condemns pigs for tuberculosis, which pigs belonged to a veterinary surgeon. I would sooner that a medical man should condemn swine than that a lay inspector should do so. I think such questions as those should

be left entirely to the veterinary officer, because the training of the veterinary officer at the present time, in pathology at any rate, is a profound one, and he is able from his comprehensive grasp of pathological problems, to take a far broader view of the pathological problem than a mere medical man. Why? The medical man, as a rule, is taught the weaknesses and frailities of the *genus homo;* the veterinary surgeon is taught the diseases to which the flesh of all the domestic animals are heir. He cannot ignore the fact that man is a domestic animal; and I therefore maintain that the veterinary pathologist, the veterinary surgeon, has a broader and more extensive view of pathological problems than the more or less narrow-visioned medical man I am not going to say a word against the large amount of work that has been done by the medical profession; no one is more ready to give them credit for work they have done than I am, but a large amount of the work they have accomplished has been done upon veterinary subjects, and they have applied their veterinary problems to the human. Particularly is that applicable in physiology. Take anything you like—I do not care what you take– and you will find that the problems of physiology have been worked out on the dog, or on the cat, or on the rabbit. It is rare that the medical physiologist has the opportunity to make a physiological experiment upon man—Professor Boyce will understand exactly what I mean—I mean, for instance, as regards the examination of the secretions. He has not the opportunity unless some accident occurs and a fistula is produced which he can take full advantage of. Take the most recent experiments in digestion, conducted by B—— and S——; they were all done upon the domestic animals. I maintain that a veterinary surgeon who has to study the domestic animals, no matter which, in health or disease, is the man to give an opinion upon the pathological process occurring in the domestic animal; and if that is the case then he is the proper man to say when meat is proper food for consumption. I am not going so far as to say that the veterinary officer should have a special department created for him. Probably the ideal system would be for such a department to be created, but I think I know my profession and the members of it, and I know that they are quite willing to work along with the medical officer of health provided they are not handicapped too much, and that whilst working under a superior officer they have comparatively a free hand, because, naturally they do not want to be vetoed on a question where, manifestly, they have greater knowledge than medical officers of health.

Mr. J. S. Lloyd: I am very glad to have an opportunity of adding my quota of thanks to Prof. Boyce for his paper. I wish to state that, whilst there is much in the paper with which I, and no doubt many other veterinary surgeons, agree, there are also other statements and conclusions which will stand criticism. The first interesting statement is that in paragraph 3 on page 100 where Prof. Boyce says: "I know of instances of this, and especially of

an example of special interest to this discussion, where the cowkeepers have co-operated with the Health Authority and have established an efficient veterinary supervision of their animals." Particulars as to how far this co-operation extends would be of interest to myself at any rate, and I would like the Professor to say where the co-operation began and where it ended. Does it deal with the sanitation of the cowsheds and dairies or only the health of the cows? To a certain extent I agree it would probably be beneficial and to be desired, but not if the veterinary inspection is to be dragged down to the cowkeeper's level. In paragraph 4 on the same page he says: "There is no longer any question that veterinary science can render an immense help to owners of the ever increasing cattle breeding stations throughout the world." Evidence of this has already been seen in England by the extirpation of rinderpest, pleuro pneumonia and foot-and-mouth disease, but the public and also those in authority have short memories, and now the veterinary surgeon is, to a large extent, superseded in the Board of Agriculture by the lay element as far as administrative control is concerned. On page 102 statements are made as to the employment of veterinary surgeons by the colonies and also in foreign countries. These speak well for the colonies and other countries, and say as plainly as possible that the mother country has much to learn from her daughters. I agree that more energetic efforts should be made by the veterinary profession to capture many of the posts which fall to medical men, or, to put it in another way, which Mr. MacCallum has emphasised very strongly this morning (and I would like to endorse every word he has said, and also to a very great extent what Prof. Mettam has said,) posts which the medical men have robbed the veterinary profession of. I say myself that medical men have usurped positions that ought to have been held by veterinary men.

I will give you an instance of this; I think I am correct in what I am going to say. Some years ago a veterinary surgeon was employed at the Lister Institute in connection with sera-therapy in the treatment of diphtheria. That gentleman, Mr. W. Robertson, was appointed bacteriologist for Cape Colony, and I believe his post was never filled up, and it is probable that it is now occupied by a medical man—I do not say it is, but I think it is—and I suppose the whole of the work is now done by that medical man. Another example of grasping by the medicals is that of the action of the Local Authority of Blackburn in regard to the notification of anthrax. I have in my hand a circular sent out to farmers, cattle dealers, butchers and others. It says:

The Corporation of Blackburn desire to bring to the notice of Farmers, Cattle Dealers, Butchers and others the great increase in the number of cattle and pigs dying from Anthrax.

The symptoms of Anthrax are:—

The affected animal is dull, and disinclined to move. If one of a herd or

flock is attacked the fact is indicated by the separation of the sick animal from the rest. There may be an occasional shiver. Sometimes a little blood is discharged from the nose and also with the fæces, and from time to time the animal will cease to feed, and stand with the head bent towards the ground. On closer inspection it will often be found that there is a good deal of swelling under the throat, extending down the neck; and the swollen part will at first be tender to the touch and hot, but as the disease goes on it becomes insensitive, cold, and clammy. The shivering fits now become more frequent, and, perhaps, while these signs are being noted, the animal will suddenly roll over on its side, and, after a few violent struggles, expire.

In most cases the sign of an outbreak of Anthrax is the discovery of a dead animal in the pasture or byre.

Both in the interests of the owners of cattle and pigs and the Corporation it is of the utmost importance that Anthrax should be stamped out, but this can only be done by a prompt notification and disinfection of all places where cattle or pigs infected with Anthrax have been kept.

For the purpose of encouraging prompt notification of all cases, or suspected cases, of Anthrax, the Corporation will pay to the person notifying, 2s. 6d. for every case of Anthrax (proved by subsequent inspection) promptly notified to the Medical Officer of Health, Ainsworth Street, Blackburn.

All sudden or suspicious deaths of cattle and pigs should, therefore, be immediately notified to the Medical Officer of Health.

The Corporation also wish to remind Owners of cattle and pigs and others that every person having or having had in his possession or under his charge an animal infected with Anthrax, or suspected of being so infected, is liable to a fine not exceeding £20, if he does not with all practical speed notify the case to the Police of the District in which the animal is or was.

Notification received by the Medical Officer of Health will be passed on to the Police.

By order, LEWIS BEARD, Town Clerk.

Town Hall, May, 1905.

Why should it be notified to him, I want to know? He has no status at all under the Contagious Diseases of Animals Act. The anthrax order says distinctly that the case shall be notified to the nearest policeman, by him to the inspector, and by the inspector to the Local Authority, and that the Local Authority, when it receives information of a suspected case, is bound to employ a veterinary surgeon to investigate it. I think it is a want of modesty on the part of any medical officer to suggest such a thing as happened at Blackburn. I may add that in this particular instance, when the matter was pointed out to the medical officer, the authorities of Blackburn simply printed in red ink at the bottom "Notifications received by the Medical Officer of Health will be passed on to the police"—a clumsy attempt to make their error legal. Take the case of Blackpool. In that city a veterinary inspector was appointed a few years ago. He was appointed as a thoroughly qualified meat inspector, and to have all the powers that the law provides for a meat inspector he should have been appointed an Inspector of Nuisances under the Public Health Act of 1875. But nothing of the sort was done. When he found any diseased meat he had to run and fetch the Medical Officer of Health, or the Inspector of Nuisances before it could be seized. His post was such a thorny

one that he had to resign, and it was not filled up by a veterinary surgeon. The same thing also happened at St. Helens.

Prof. Boyce says that the way to capture the posts is to be equipped. I think that is rather a half statement. I will say that veterinary surgeons ought to be equipped to capture the posts, but I think the posts have to be created first. I will give you an example of that. There are hundreds of sanitary inspectors in this country who have obtained the certificate of the Royal Sanitary Institute, and they could not possibly get an appointment as a sanitary inspector without it. There are any number of veterinary surgeons ready for municipal and public appointments at this present moment who cannot get those appointments, simply because there are no appointments vacant for them. Because a Medical Officer of Health has a D.P.H. degree it does not follow that he is best qualified to judge the ill-effects on man of diseased meat. I think I am correct in saying that, because I have been through a course of public health work myself, and I know exactly what the D.P.H. men have to do, and this is the result of my judgment. I will say, as Mr. MacCallum has said, that a Medical Officer of Health will assume and presume almost anything. Take the position of the sanitary inspectors at the present day. The Medical Officers of Health are simply ousting them and making them tools in their own hands. The Chief Sanitary Inspector of any town practically speaking is simply a man in the hands of the Medical Officer; his position is impossible. Only the other day the county borough of Marylebone in London advertised for a surveyor to the Chief Inspector under the Medical Officer of Health. There was a very strong article on that in last week's *Sanitary Record*, if anybody would like to read it. That there are not sufficient veterinary officers attached to Health Departments may be true; it depends upon the veterinary officer's position. If he is only to be the cats-paw or the tool of the Medical Officer of Health his position from several standpoints will not be a bed of roses—always in the background giving expert information and advice, but rarely reaping any reward. Certainly public opinion wants educating, and when the change comes, if the position of the Veterinary Officer of Health is worth it, there will be plenty of men to fill the vacancies.

The second sentence from the end of paragraph 1 on page 103 requires a little alteration, I think. It has been pointed out to Prof. Boyce this morning that perhaps it would be better if it was altered. I would make the sentence read like this: "No one is better qualified than the veterinary surgeon to pronounce an opinion upon the soundness or otherwise of a carcase or piece of meat, or the fitness of an animal to provide milk." I think I can defy Prof. Boyce or any other medical man to come forward and say that there is any other professional man better qualified for those purposes than a veterinary surgeon.

Mr. W. HUNTING: I desire, as a veterinary surgeon, to thank Professor Boyce for the way in which he has dealt with this subject. I am quite sure that if he had belonged to our profession, or knew us a little more intimately than he does—and that is very close—he would have been more flattering even than he has been in this paper. But I cannot help thinking that he has expressed two thoughts in two sentences just as well as they could have been expressed—they have both been referred to by previous speakers. "A far more energetic effort should be made by the veterinary profession to *capture* many of the posts which now, almost as a matter of routine, fall to medical men. The way to capture them is to be equipped." That last sentence contains a text for a sermon. The word "capture" is beautifully chosen, for these posts are liable to capture by various kinds of "equipment" and if we really hope to capture them we must look after them very closely. We must remember that every paid post in this overcrowded kingdom is held by somebody and sought after by somebody else, and as the medical men had a start some years before us they naturally dropped into these little posts, and they do not mean to give them up. I myself had a little illustration of the medical man's asumption and presumption, as mentioned by the last speaker. Recently the Metropolitan Asylum's Board in London intended to build some stables. The plans were got out, and the architect asked me to go through them with him. I suggested some alterations which saved some money, and, as I thought, improved the stabling. They afterwards consulted a bacteriologist, who altered the whole of the plans for the stables, and who believes now that he is an authority on that matter. It is unfair to us in every way that a medical man should accept such a position and go absolutely contrary to us, knowing that he knows nothing whatever about it, or if he does not know that, his ignorance is really too preposterous.

Then Professor Boyce at the end of his paper tells us, "It is the duty of all those interested in the profession to educate the public." That is very important, quite as important as the next sentence, "And to train and prepare the veterinary surgeon for the part which he should properly take." We all want training and educating all round; but when you have got all this equipment and all this training you will have to remember that blood is thicker than water, and that one man will shove his friend into a job whenever he gets a chance, and his friend will stick there as long as he possibly can do so. We have an uphill game to fight, and that is our difficulty. Many of our big men are so careless and casual about it that they will not take the trouble to fight, but they will not get anything unless they do.

I want to say one or two words upon what we have done, and, as Mr. MacCallum said, in favour of that little conceit that we ought to have. Everybody now is yielding to the idea that the veterinary surgeon is, from his training—I will not say anything about anything

else—the best meat inspector. All over the world it is acknowledged that the man who is a trained pathologist in relation to domestic animals must be their best inspector: that they are "equipped" nobody disputes. Then as to milk, undoubtedly the cow must be inspected by a veterinary surgeon—because mistakes will happen. You know a medical officer of health went to Hendon and found what he thought was scarlet fever in a cow. It cost the owner £1100, and killed him by worry in about twelve months—and then they found out that the disease was an eruption upon the teats and was not scarlet fever at all! Every man to his own trade, and that is what the medical officer of health has never learned yet. I want to say a word about the scientific part of the question and our relation to the public, which is not only concerned in the inspection of meat and milk, but also with regard to such transmissible diseases as glanders, tuberculosis, anthrax and rabies. I do not want to be nasty, but during the last twenty years bacteriology has been on the crest of the wave. It has been there so conspicuously that one is apt to think that if a man is not a bacteriologist he cannot be a scientific man, I venture to think that clinical medicine is every bit as scientific and useful as bacteriology, and I assert that it has up to now done more for human progress and for the pathology of disease than all the bacteriology put together. When a man wants me to submit my veterinary clinical observation to his microscope I wonder at his confidence, because it is much easier for me to recoguise a thing 1½ inches square than it is for him to recognise something which is 1000th of an inch. As a matter of fact, there are very few specimens that you can send to three bacteriologists and not have three different opinions about them. The diseases in this country that we have stamped out, that we have scientifically conquered, are cattle plague, pleuro-pneumonia, rabies, and foot- and mouth disease, about which no bacteriologist knows anything. They have as yet discovered nothing. We stamped those diseases out by clinical observation. We are not wanting in prominent workers on modern lines. There is no necessity to refer to Chauveau whose name everybody knows, or to the practical work of Nocard. But we have a gentleman present at this meeting about whom I desire to say a word. When you want to insure your life in an insurance company, they ask you a whole lot of questions, and in the form they send you to fill up the first question is "What did your mother and grandmother die of?" and if they happened to die of tuberculosis an inference against you is drawn, because medical men thought it was a hereditary disease long before Koch discovered the bacillus. They will not give it up, this theory of heredity, although Professor Bang has shown them he can breed healthy animals from diseased parents, and that heredity has nothing whatever to do with the transmission of the disease. I desire to claim that public health and human protection owes more to Professor Bang's corrections of that error than to any other bit of work that

has been done on tuberculosis. I do not want to say much against the assumption and presumption of the medical man, because he generally gets his reward. Anybody who was present at the Glanders Commission in London and heard poor Dr. Hope being asked what he knew about glanders will be merciful. Dr. Hope said he was chief officer—(I will not swear to the exact words he used)—but anyhow he was chief of the Diseases of Animals Act in Liverpool, and then to every question he was asked of any importance about glanders the only reply he could make was, "Really I do not know, I think you had better ask the veterinary surgeon." That was an absolute confession, without shame, that he had "captured" a post without being "equipped" for it.

Mr. T. Eaton Jones: I should like to say, sir, in order to show you the good feeling that exists between Dr. Hope and myself, that he has just telephoned to me saying that he is going to send fifty copies of the Public Health Guides down to this meeting, and will be glad if you will accept them, although they cost a guinea each.

Mr. Hunting: I allow Dr. Hope is a first-class man, and a good M.O.H., but he is not a veterinary surgeon.

Mr. J. T. Share Jones: I think you will agree with me, from what has already been said by previous speakers, that a great amount of reform is absolutely necessary in connection with this question of public health and veterinary science. To us, as practical men, the question arises as to how these reforms may be brought about, and as a young man I think the more sane method would be to endeavour to get these reforms brought about not by slinging mud at other competitors for various branches of the work. Public health to me appears to be rather a sacred problem. It affects the whole of the community. Every man and woman in this country is affected by the question of public health, and it therefore becomes not a question for the veterinary surgeon alone, not a question for the medical man alone, and not a question for the policeman or the J.P., it is a question for the politician; and to secure legitimate reforms in connection with this question, it will be necessary for us to look at the political aspect of the situation. It is a big question, one which takes a great amount of dealing with; but I think if you examine it thoroughly you will come to the conclusion that the forces necessary to deal with it are very ample, but a further examination proves that they are absolutely unorganised. We find that the slackness which has been going on is simply due to the fact that there is no organisation and no fixing of responsibility. There is absolutely no legislation to deal with the question, and I think that is the first point we must consider. It is not for us to come here and say "we are the people"—it is not for the medical man to say "we are the people;" it is for others to judge, and in my opinion each of these competitors for these various posts, be the competitor a veterinary surgeon, a medical man, a butcher or a layman, should lay his case before the proper authorities. We do not

want a scuffle amongst each of the classes for these posts, but we want a specific enquiry into the qualifications of the various claimants, and that enquiry should embrace an enquiry into the specific education of the various claimants We all here agree that we are the proper people to undertake the inspection of meat and milk ; but it is not enough for us to come here and say so to each other. We must be prepared to submit our claims to independent people, and thereby get the recognition which is absolutely necessary. I think it is generally agreed, even amongst ourselves, that our claims are practically unknown to the community at large. They know very little about us ; they know nothing about our general curriculum, the training which our boys have to go through before they can become veterinary surgeons. Some extremely well educated people have not the slightest knowledge as to the difficulties of our examinations. What is that due to ? I think primarily it is due to ourselves, and we have only ourselves to blame in the matter. If you look back at veterinary education you will find that, in the past, we have been too apt to look upon education as absolutely synonymous with the acquisition of knowledge alone. Education is nothing of the kind. For the last two or three centuries educational reformers have been endeavouring to convince us of the fallacy of that idea. Education is nothing more or less than an aggregation of those influences whereby the boy grows up to be a good and useful citizen to his fellow men As regards ourselves. all we endeavour to do is to get our knowledge as quickly as we can and profit ourselves by it. But our education should not terminate there. Do you think our mission on this earth is finished when we carry on a veterinary practice and collect together a little money ? If you examine the public bodies of this country, you will find it is the exception rather than the rule to find the name of a veterinary surgeon on those public bodies. Somebody must carry on the business of these public bodies, and why should not we take our part ? As Mr. Eaton Jones said very pertinently a short time ago, if veterinary surgeons made it their business to secure representation on these bodies by putting themselves up as candidates they would be able to give advice, and their advice would be treated with that great respect which is already shown to the advice of members of other professions who take up these various branches of public work. I do not think anything further is necessary. If we are to further the problem, some resolution should be sent up to the political authorities calling attention to the want of organisation in dealing with public health, and asking for an enquiry dealing with the specific education of the various claimants to the different departments.

Mr. G. Banham : Before the discussion closes, I should like to make an appeal to Prof. Boyce to educate his medical students in the proper way. We have been told that the public ought to be

educated, and that veterinary surgeons ought to be educated, but nothing has been said at this meeting as to the education of the medical man himself; and Prof. Boyce is in such a position that he can bring the position of the veterinary surgeon of this country before his students, so that when they get into the world, as medical officers of health, they will understand the position that we occupy with regard to themselves. I may say that, in my town, we have nothing to guide the Medical Officer of Health, but that the Medical Officer of Health never undertakes anything out of his own sphere, and if ever he wants information of any kind with regard to animals he always applies to me.

Reply by Prof. Boyce.

Prof. Boyce: I purposely made my paper to contain as little detail as possible, because it is obvious that one could extend this theme into a volume; but that was not the purpose I had in view. The paper has already done perhaps some good in calling attention to certain points. But first of all I beg to thank you for the patient way you have discussed it, because after all it is really an improvised paper. I am not a veterinary man, and you have therefore been exceedingly courteous to me in taking any cognisance of it whatever. Several gentlemen have criticised various points, and quite rightly, too. There are heaps of controversial points in the paper. I do not think it will be necessary to go in detail into the various points; I will simply refer to one or two matters which struck me as being of the most importance, and at the same time thank the various speakers for having drawn my attention to them. As regards the relation of the veterinary officer of health to the medical officer of health, that is, of course, a pretty knotty point, in fact that is obvious from the discussion which has taken place. I think that in time the more prominent the veterinary profession becomes the more certain it will be that the veterinary officer will hold a self-standing position; there is no doubt about that (Hear, hear). But things have to grow. As regards the intimate relationship which exists between the veterinary officer of health and the medical officer of health, I will give you an instance with regard to myself. As one of the public analysts of the city of Liverpool, I am under the medical officer of health; I can do nothing on my own initiative; the matter has to be sent to me for reference; I give my opinion, and I know nothing more of it. If I am asked to come up as a witness I do so, but I am simply sent as an expert and as an aid to the medical officer. I do not think that I exactly lose my dignity by being called upon in that way; but I quite see the idea from the veterinary point of view, and deeply appreciate the position that the veterinary officer is put in at the present time. Mr. MacCallum raised many very interesting points, one of them being a point that always interests me, namely, the financial aspect, which was really at the bottom of his mind in connection with what he

said. There is no doubt that education in this country has been very much starved from a financial point of view. The curious principle exists in this country that nearly everything is done voluntarily. Voluntary effort has made our country; it is probable that we owe our strength to voluntary effort, and in that respect Mr. McCallum is simply acting up to the traditions of our race. The more private donors give to any object, educational or otherwise, the more importance it attracts, and the Government and the Municipality are bound to uphold the scheme and back it up. That is almost an invariable rule. It really comes to this, that the English Government will not make experiments in education, or in anything else; they want to see if the individual communities of the country will make the experiment first. The Government watches, and if the experiment is a successful one they will back it up with money. There is no doubt that the veterinary schools, if they are backed up by private citizens and by the Municipalities, will also be backed up by the Government.

Mr. Hunting raised a very important question, which was also referred to by other speakers, as to the way in which the non-expert, that is to say a non-veterinary man, will very often give an opinion upon a veterinary subject. That, unfortunately, is often the case. I have been particularly struck by that fact in the course of my various travels, and in reading various literature in various parts of the world. It almost invariably happens that questions with regard to accommodation for horses in stables, and suchlike things, fall entirely within the province of the medical man. That I have seen over and over again, because I have had to report on it. I lose no opportunity - and I am sure my scientific colleagues do the same - in pointing out that the best authorities on matters of that kind are those who are experts in the matters, and that is the whole essence of scientific progress—to call in those who are experts in particular subjects. I thoroughly sympathise with Mr. Hunting, and every other member of the Association, in regarding it as a very great hardship that the veterinary man is not more frequently consulted in matters dealing with his own particular line.

Professor Mettam brought forward many interesting points. None of us in this room, none of my colleagues in the various departments of this University, or in any other University, if they are working on biological lines, are not fully cognisant of the immense amount of gratitude we owe to leaders in veterinary science in the early days of physiology. We were brought up on it. The researches of the men in the veterinary schools of Lyons and Paris formed the basis of our physiological knowledge. If I may say so, it was really on that knowledge that I have always gone here; I was brought up on their teachings, and now I want to see that progress carried on to the full, and a very close union thereby

brought about between the veterinary and the medical side. I am sure that will come about, it is only a question of time.

The whole point of the paper is that there are unquestionably a large number or posts which, I think, should fall and could fall to the veterinary man if a little more stir were made, and if a little more specific training was done. I have watched a good deal in regard to that question. I have seen that, by the medical student going in for a specific training known as the Diploma in Public Health, that thereby corporations and other bodies have been obliged to select those medical students who have that particular diploma. That is a very important thing, and I think that if the same specific training was also brought about in the veterinary profession perhaps a similar result might follow. There are a large number of meat inspectors being trained at the present time in this country, and who are training them? For several years we have been training meat inspectors, men drawn from various sources, in Liverpool, over at Ashton Hall in the Institute of Hygiene. Where in London are those meat inspectors trained? If anybody should train those meat inspectors it is certainly the veterinary profession. Are they being trained in London by the veterinary profession? That is the whole point. So far as I presume to give an opinion, I would say it is the duty of the veterinary profession to see it has a complete organisation and complete authority for all the training and education necessary in relation to the disease of animals, meat inspection and so on affecting public health. (Cheers.)

Mr. W. Woods: I have the very pleasant duty of asking you to accord a hearty vote of thanks to Professor Boyce for his very excellent paper. I do not know whether all the members fully realise the great honour that has been done to this Association by a Fellow of the Royal Society coming here and giving us a paper. (Cheers . Professor Boyce is a man of great ability, in fact, so far as I know, he only has perhaps one inability, and that is that, although he is one of the busiest men in the North, he is unable to say "No" if you ask him to do a kind act. In proposing this vote of thanks, I also couple it with the request, which I know will be carried with enthusiasm by the members, that we confer upon Professor Boyce the only honour that we have it in our power to give to a gentleman who is not a member of this Association, and that is, that we make him an Honorary Member. (Cheers). I have the greatest possible pleasure in proposing a hearty vote of thanks to Professor Boyce for his excellent paper, and that he be made an Honorary member of the Association.

Mr. R. Hughes: I have the greatest possible pleasure in seconding this resolution. I know that Professor Boyce's intentions were once misunderstood in our profession, but as one connected with the Veterinary Medical Association that has been established in connection with this University, I can assure you that he has the best interests of our profession at heart, and is always willing to do

everything in his power to advance our interests. As a further proof of his sincerity, you will see in the paper that Professor Boyce frankly admits that veterinary surgeons have their claims, and in the course of his reply to the discussion he has said he is always willing to endeavour to advance our interests. I am sure it will be a great honour to us to have Professor Boyce as an Honorary Member of this Association.

Mr. T. C. FLETCHER supported the resolution, which was carried with acclamation.

Professor BOYCE, who was heartily cheered on rising to reply, said: Mr. Chairman and gentlemen, I am indeed deeply grateful to you for the honour you have conferred on me. It is one of the pleasantest things that has ever happened to me, and I am very grateful indeed to you for it. If I, as an outsider, can be of any use to you in any way, I am entirely at your service. (Cheers).

ADDRESS BY PROF. BANG, ON A NEW DISEASE.

Prof. Bang: I have asked permission to say a few words on a disease which has hitherto been unknown in your country. I believe, however, it may exist here and perhaps be rather common, but that it has not been understood as yet. It is a disease in the bowels of the cow, a chronic inflammation of the mucosa and sometimes of the sub-mucosa tissue which produces as a rule a chronic diarrhœa, which makes the cows waste. This disease was described for the first time eleven years ago in Germany by Prof. Johne and Mr. Frothingham, who considered it a case of tuberculosis in the intestines. A piece of it was shown to Prof. Koch who was of the same opinion. They were not, however, able to produce tuberculosis affecting other animals with these things. Very curiously, these alterations were only found in the bowels and also in the lymphatic glands. Until two years ago this was considered a peculiar case of tuberculosis, but two years ago Dr. Markus in Holland wrote a paper on it and called attention to this disease as a rather common disease in Holland, which was very well known in the abattoirs at Amsterdam and at Utrecht, and it was also very well known to farmers. They called cows affected with this disease diarrhœa cows. Mr. Markus, on examining these cases, found absolutely the same thing as Johne and Frothingham described. Since that time, this disease has been described in Belgium and later on in Switzerland, and you will find in the last number of M'Fadyean's journal the translation of a short article by Borgeaud in Lausanne about this disease. Mr. Bongert, in Berlin, has also written a paper on it, which I have not yet seen. I have studied this disease for two years in my own country and know a good deal about it, and therefore perhaps it would be useful if I told you what I know. When I read the paper by Mr. Markus, I thought immediately about a man in one of our Southern Islands who told me of a chronic diarrhœa in cattle. At first I believed it was what you so often speak of here in England as a disease caused by the small strongylus. I saw such a case

once, and found some strongyles in the stomach, but so few that I did not believe it could be the cause of diarrhœa. After I had read this paper of Markus, I wrote to the man and asked him to send me some cows. I got two, and they were absolutely of the kind described by Johne and Markus. Since that time I have had at least fifteen cases in my clinique; I have kept them under observation and made many experiments, and I have had specimens sent to me from different parts of the country. I think I am able to say it is no uncommon disease in Denmark, and it must be a common disease in Jersey. We import cows from Jersey, and in the imported cows we find the disease. It is not a disease belonging to a special breed. They found it for the first time in Germany in a Dutch cow, and in Belgium in Jersey cattle, in Denmark I found it in Jersey cattle and in the two Danish races, the red and the black and white. As a rule they are young cows. Sometimes the diarrhœa is very strong and sometimes it is not, the cows for some weeks and months having no diarrhœa. The cows then seem to be a little better, but they will not give any milk and they cannot be made fat. Everybody who knows the disease says they will not recover. I will not deny that in some cases they may recover, but I believe in bad cases they never do so. After some months or so they will be slaughtered because they have gone wrong; and then you will find in the lower part of the ileum, and sometimes also in the cæcum and colon, the mucosa thickened three or four times the normal perhaps. You will see it lying in folds, but you will not find any big ulcers. If you examine it carefully you will find, as a rule, between these folds quite small erosions; you will find the mucosa thickened and sometimes the submucosa. You will find the lymphatic glands are also a little swollen. You will find these alterations in cows absolutely free from tuberculosis. I have seen many cases where the cows were absolutely free from tuberculosis in all the organs. We have imported some thousands of cows from Jersey which are absolutely free from tuberculosis, and in such herds I found this disease. When we examine sections, we find that the villi, as a rule, are altered. They are more or less thickened, of irregular shape, and sometimes the edge is necrotic. The glands are all right. Sometimes the villi have the appearance as though they were growing together. You find the tissue filled up with large epithelioid cells surrounded by small, round lymphatic cells, and in some cases with giant cells. These epithelioid cells are a specific thing in this disease; they lie mostly in the midst of the villi, just where the lymphatic canals are. They are to be found in the mucosa, and sometimes they develop

themselves under it. All these epithelioid or giant cells are filled up in some cases with acid-resisting bacilli, that is to say small bacilli a little shorter than the true tubercle bacilli, but coloured in just the same way as the tubercle bacilli. Then you will find in the lymphatic gland, if it is swollen, a certain infiltration of such cells and also in these cells a number of tubercle bacilli. The number of these bacilli is sometimes immense. I have some preparations under the microscope which you may see. Sometimes there is not such a large number, and it will be a little difficult to find them, but as a rule it is a most easy task. You will see it is a disease which resembles tuberculosis very closely.

The question is, is it a tuberculosis? I do not believe it. Most writers upon the subject are inclined to think it must be tuberculosis, but they have not been able to produce tuberculosis by inoculation. The only one who seems to have succeeded (and it was only in a very few cases) is Lienaux. In almost all my cases I tried to inoculate the disease to guinea pigs, rabbits, goats and calves without result. Only in one case was I able to produce tuberculosis in the guinea pigs, and this cow had at the same time a little tuberculosis—I admit it was very little, but the cow had tuberculosis. In no other case have I been able to produce tuberculosis after inoculation, and when I remember also that I find this disease in cows that are absolutely free from tuberculosis, I incline to believe that it is not tuberculosis. It is a particular disease produced by a acid-resisting bacillus.

I have made many experiments to try to cultivate this bacillus, but hitherto without result. That is very curious, because the common acid-resisting bacilli seem to be rather easy to cultivate. With regard to the circumstances under which this disease appears, it seems to me to be an enzootic disease. The man who first told me about the disease is a very clever young veterinary man, Mr. Neilson, who is working on the island of Laaland, one of our Southern islands, a very good, fertile land. He has observed the disease on two big farms for years. One of these farms had about 200 cows, and they lose from ten to sixteen cows every year from this disease; and on another big farm they lose about eight or nine cows every year, so that you see it is a very bad disease on such farms where it exists. An elderly man has told me that twenty-five years ago he knew the same disease on other farms on the same island, but that the disease has disappeared at present. It is a very chronic disease. If a calf is sold from such a farm, sometimes it will not show the disease until a year after its arrival. We have the same thing with

Jersey cows. They seem to be healthy when they arrive, and then a long time after they break out with this disease. I find in some cases we are able to fix the diagnosis in the living animal by examining a little bit of the mucosa recti, in which we may find the bacilli. Of course it is only in such cases where the colon and the rectum are affected, and therefore if you do not find the bacillus in such a scrap from the mucosa it does not at all prove it is not this disease.

Another point worth mentioning is that I know of cases where the cow had no diarrhœa at all, and nevertheless died of this disease. I examined specimens from each case. I should be very glad to hear whether this disease exists in this country; I think very probably it does.

The Chairman: Professor Bang will exhibit some specimens under the microscope downstairs, and you will have an opportunity of discussing this interesting question with him.

INSECTS AND TICKS IN RELATION TO ANIMAL DISEASES.

By R. Newstead, A.L.S., Etc.,
Lecturer, Liverpool School of Tropical Medicine.

The discoveries of the extraordinary part played by insects and ticks in the transmission of disease in man and the domesticated animals has, during recent years, made rapid strides in medical and veterinary science; and it is highly satisfactory to say that many of the discoveries have led to much more healthy conditions; and in the case of malaria and yellow fever these terrible diseases have, in certain regions, been reduced to the lowest possible minimum, if not entirely exterminated. It is not intended, however, to discuss the numerous animals which are concerned in the transmission of diseases in man; but to view the salient characteristics of those flies and ticks which are the known carriers of disease in the domesticated animals.

Insects.

Under this section we have a large number of blood-sucking species of which the "Tse-tse flies" and the "Stable flies" or "Storm flies" are well known carriers of Trypanosomiasis; but the horse flies or gad-flies and the forest flies may also be concerned in the transmission of disease in animals.

Of the tse-tse flies there are eight species and two or three well marked varieties. These peculiar insects are strictly confined to the African continent, extending from the Gambia on the West to Somaliland on the East; Southwards into North Zululand, and Northwards as far as Lake Chad.

Although distributed over such a vast region these flies are extremely local, being confined to narrow tracts or zones known as "fly belts" associated with streams and swamps.

Through the agency of *Glossina palpalis* and *G. fusca* the *Trypanosoma gambiense* of sleeping sickness is carried from man to man; and the tse-tse disease of horses, etc. (*Trypanosoma Brucei*) by *Glossina morsitaris*, and possibly also by other members of the Genus. These flies belong to the extensive family Muscidæ of which our common house fly (*Musca domestica*) may be taken as a type; but in their structural characters the tse-tse flies are more closely related to the common stable fly (*Stomoxys*

calcitrans) of this country. They differ, however, in many essential details, especially in the characters of the wing neuration and the proboscis; the pupiparous habit of the female is, however, absolutely unique among the members of the muscidæ.

Surra (Trypanosoma Evansi) of India and the Philippine Islands is transmitted from one horse to another by the stable fly (*Stomoxys calcitrans*), and possibly also by other members of the genus.

Stomoxys calcitrans is an almost cosmopolitan in its distribution and an extremely common insect. In this country it is generally to be found in the immediate neighbourhood of stables, and the larval stages are passed in horse dung. It is a vicious biter, and although it bears a striking resemblance to the common house fly, may be distinguished from the latter by the form and character of the buccal organs.

It is highly probable that the gad flies (Tabanidæ) and the forest flies (Hippoboscidæ) are also effective carriers of Trypanosomiasis, but the evidence, so far, is of a circumstantial nature.

Ticks (Ixodoidea.)

These animals are either permanent or remittent parasites which suck the blood of man, mammals and birds. All the female ticks lay eggs which produce hexapod larvæ. In those species affecting cattle and dogs the larvæ are usually found congregated together on the summits of various grasses and other plants where they remain for indefinite periods, awaiting a passing host. After a feed of blood the animal casts its skin and assumes the nymphal stage in which it attains an additional pair of legs. The animal then takes another feed of blood, casts its skin and becomes sexually mature. In many instances the mature female is of the same size as the male, but after engorgement the former may increase in size from twenty to thirty diameters. The engorged female invariably leaves the host, seeks some place of concealment, lays her full complement of eggs and then dies. The females are usually very prolific, in some instances as many as two or three thousand being laid by a single individual.

The habits of these animals vary very considerably, in some instances (*Rhipicephalus decoloratus*, etc.) the whole life cycle, with the exception of the egg, is passed on one host. In *R. evertsi* the larval and nymphal stages are passed on one animal, and after effecting the second moult they seek another host. Or again, there are those ticks which leave the host at each successive moult, requiring three hosts to complete their metamorphoses of which *Rhipicephalus appendiculatus* may be taken as an example.

Ticks are the intermediary hosts or carriers of the diseases known collectively as piroplasmoses comprising a group of intercorpuscular protozoa belonging to the genus Piroplasma. These disease producing protozoa are of the utmost importance to the agriculturist and settler, and the various diseases which they produce are known in different parts of the world as Malignant Jaundice in dogs, Blackwater and Redwater fever, Texas fever, Tick fever, Carceag, etc.

The various species of Ticks which are known to be responsible for the transmission of these diseases are here briefly summarised.

Hæmaphysalis leachii is the Tick which conveys the *Piroplasma canis* from dog to dog. In this case the adult females only can transmit the disease and these must be the progeny of an infected parent. Thus the piroplasma passes from the infected female Tick through the eggs, the larvæ and nymphis, the infective stage being reached only in the adult forms which are alone capable of transmitting the disease to the animal from which they take a feed of blood. Thus it will be seen that both hosts are absolutely essential for the development of the organism producing the disease.

The intermediary hosts of Piroplasma ovis (Carceag) are Rhipicephalus bursa in which the transmission is effected in the same way as in P. canis.

The Ticks suspected of the transmission of *Piroplasma bigeminum* in South Africa and India are *Rhipicephalus decoloratus*, *R. evansi*, and *Hyalomma agyptium*.

Texas Fever (*Piroplasma bovis*) which has a world wide distribution is conveyed by the larval stage of *Rhipicephalus annulatus* and its varieties, and also by Ixodes reduvius. While the Rhodesian or African Coast Fever (P. parvum) is probably transmitted by Rhipicephalus appendiculatus.

It will be seen therefore that Ticks play an important part in the transmission of Piroplasmosis which may be counted among the most latal diseases to which domestic animals are subject.

N.B.—This paper has to be presented in a somewhat condensed form, but it is the intention of Mr. Newstead to supplement the text by a series of lantern illustrations, accompanied by brief explanatory references.

Discussion.

Mr. Hunting: Mr. Goodall has written to say that it is not possible for him to be present and open the discussion, but he has sent his remarks in writing, and the question is whether you would like them read or not.

Mr. Hunting read the following remarks by Mr. T. B. Goodall:

One must agree entirely with the opening sentence of the essayist, referring to the discoveries of the part played by insects and ticks in the transmission of disease—discoveries which, during recent years, have made rapid strides. To me it is certainly some satisfaction to have lived to see the realisation of theories I advanced thirty years ago, and which I have persisted in ever since, notwithstanding ridicule from almost all quarters. Sooner or later, I said, it would be found that a knowledge of entomology would be as necessary for the student of medicine and pathology as the then budding science of bacteriology.

It is interesting to bring to mind, in these days of enlightenment, the storm of ridicule from the old conservative school that greeted the "germ" theory of disease. Those days are past. But the sister science of entomology, until quite recent years, has been sadly neglected, and there are not a few men, eminent in the particular study of bacterology, whose knowledge of the life histories and anatomical structures of insects, is very limited. And yet, knowing as we now do, that many of these are the carriers of pathogenic organisms from host to host, a knowledge of their mode of life, and structure, becomes imperative.

The essayist tells us of some insects that are now well known carriers of disease – and mentions others that *may* be.

The most recent literature on the immunisation of animals against diseases induced by blood parasites points to the benefit derived in this direction by direct inoculation of virulent blood from an affected animal into the blood-stream of healthy ones. (Prof. Stockman's recent report to the Board of Agriculture).

Dr. Merton Coutts, writing of Heartwater and Horse Sickness in *The Journal of Comparative Pathology*, in December, 1905, says: "These diseases may both be induced by inoculation, but not by infection."

In Professor Stockman's Report on Rhodesian Redwater in the same journal in March, 1905, he makes a point of the immunity of coast-bred animals, and mentions incidentally that direct inoculation of blood from a sick to a healthy animal does not produce disease in that animal. (It would be instructive to know whether the inoculation, irrespective of inducing symptoms of disease, makes the animal immune) and in his joint article with Dr. Theiler in June, 1905, it is taken as a proved fact that inoculation with virulent blood will immunise a horse against Horse-sickness.

Let us note then, as proved, that some of these diseases are

transmitted by inoculation, and that direct transfusion of virulent blood from a diseased to a healthy animal renders that animal immune. The point I wish to bring to your notice here is that the blood-sucking flies are probably Nature's inoculators—since the piroplasma, trypanosoma, and all the hæmatozoa, which are causes of disease on introduction into the blood or tissues of the higher multicellular beings must have co-existed with their hosts from the dawn of creation—ages before man, as a thinking, intelligent being appeared on the stage at all.

A study of the mouth organs of the blood sucking flies shows us how micro-organisms have been transmitted from host to host; for these organs are the most beautifully made inoculating instruments imaginable, that is, instruments constructed in such a manner, that being smeared with blood, or other animal fluid, in which these micro-organisms exist, they insert a minute speck into the next host on which they alight and so become, not only disease-bearers, but Nature's unconscious agents for rendering animals immune from severe attacks of the special disease of which they are the bearers.

In our experimental inoculations we are careful first to isolate the causal organism, and then introduce that, or its products, into the subject of experiment, and so induce disease or its equivalent: but Nature's inoculators act in the same way as our most recent investigators have found best -they pass on virulent blood, and in this they not only introduce into the new host, disease-inducing organisms, *with their toxins*, but with them a few leucocytes and *their antitoxins*, thus passing on not only the disease but also its antidote.

In this sense we can see how the blood-sucking flies may have been instrumental in carrying disease inducing germs from host to host, and how, at the same time, they have *generally* also carried with them the nucleus of the means of resistance.

The essayist mentions the Stomoxys calcitrans as being almost cosmopolitan, and extremely common. There is no doubt it is, as a family, but there are very many varieties. The one we find in sheep is very large, that in horses and in houses small, and the one found in dogs intermediate between the two, and the larval stages are passed not in horse dung only, as the essayist says, but in almost any dung. I have reared it in the dung of rabbits, etc. The varieties appear to have particular likings for particular animals. Speaking of larvæ, I think it is no less an authority than Major Ross (to whom the world is indebted for so much enlightenment) who says that larval anopheles will live and thrive as well in clean, or even brackish water as in foul. My experience with our home gnats and mosquitoes is quite opposed to this. The larvæ of all insects are exceedingly voracious. They begin feeding as soon as they emerge from the egg, and, except at the times of their moults, they gorge until they pass into the pupa stage. The gnats and mosquitoes are no exception to this. Their food consists of the minute organisms

that swarm in dirty water, and they speedily die if placed in water that is quite clean. This I have proved. I will grant that a female may, in desperation, deposit her eggs on clean water when there is none other available, but the larvæ would never mature in this.

The essayist tells us that Glossina Morsitans (Tsetse fly) is pupiparous. Might I ask if he has personal knowledge of this? Bruce states that the fly is viviparous, and that the female gives birth to only one larva, which pupates some time after leaving the body of the mother.

Either of these conditions is so absolutely unique in the order of the Muscidæ, and so utterly different to the method of reproduction of every other member of the order, (which are all oviparous, the female generally laying hundreds of eggs) that one wonders if it is possible that parasitism may have been mistaken for larvæ in the female abdomen. I have had remarkable instances of this. Amongst many scores, *one* may perhaps illustrate my point.

I once took a larva of the Vapourer moth. This pupated, but instead of a moth emerging from the pupa there came forth two large flies! Muscidæ *not* Ichneumonidæ. Of course the eggs had been deposited in the caterpillar, and the larvæ had lived in the non-vital parts of their strange host until it pupated. I could mention scores of cases just as curious, but this one is sufficient for the purpose of suggesting the possibility of parasitism being mistaken for a phenomenal mode of reproduction in the Tsetse fly. I was under the impression that the Hippoboscidæ were the only pupiparous flies.

I cannot speak with any authority on the *rôle* of the tick in the dissemination of disease. I know that most interesting experiments are being carried on at the present time, and our essayist has given us food for much reflection with regard to them. They are spoken of as the intermediary hosts, or carriers of the diseases known as piroplasmosis. In our home redwater I have found the piroplasma, and I have found the ticks on the affected cows. I have saved gorged female ticks, but have not yet had a brood of eggs.

Referring to what the essayist says of the Hemaphysalis leachii —"The piroplasma passes from an infected female tick through the eggs, the larvæ and the nymphæ, the infection stage being reached only in the adult form,"—Might I mention that the reproductive and the somatic elements are as distinct in the tick as in the higher animals, and that as it has been held impossible for the "germs" of a contagious disease, such as tuberculosis, to pass from the dam to the embryo—except in the rare instances of uterine disease of the dam—so I should hold it to be equally impossible for the piroplasma to pass from mother to egg in the tick.

An explanation of this phenomenon might be found in the fact that it is a habit of larvæ to eat their egg shells on emergence; a larval tick might in this way take infection from the outer side of the egg shell infected in the mother's body.

What I would like to know from the essayist is—Have the piroplasma been demonstrated in the eggs and larvæ at their various stages?

Piroplasma *can* pass through all the stages of the life-cycle of ticks, it might be possible for the larvæ of such flies as pass this stage in filthy water to become there infected, and to pass the organism to the adult fly, and then infect a warm-blooded host.

Mr. R. Newstead: With regard to Mr. Goodall's criticisms, some of his remarks are extremely interesting. My paper has evidently drawn from him what I should have expected it would have done at this meeting. With regard to the *Stomoxys calcitrans*, I briefly stated that the metamorphoses were passed in horse dung. It is a well-known fact that it is a general dung feeder, but it is said to feed in preference on horse dung. I made a broad statement simply because I had not time to go into all the details. Then with regard to the *Anopheles* larvæ being found in both clean and foul water, I think he must have misunderstood Major Ross. We all know that both *Culex* and *Anopheles* occur together occasionally, but the larvæ of *Culex* are usually found in foul water, water which is heavily charged with decayed vegetable matter on which the larvæ prefer to feed.

Prof. Mettam: Is Mr. Newstead simply replying to Mr. Goodall's observations, because I hope the discussion on the paper is not closed?

Mr. Newstead: I am combining the two.

Prof. Mettam: I understood that this was simply Mr. Newstead's opening address upon the whole question.

The Chairman: It was not observed until a few moments ago that Mr. Newstead's intention was to amplify his paper before Mr. Goodall's contribution was read; but as there is so little time the idea now is that Mr. Newstead will kindly make some observations on Mr. Goodall's paper and also exhibit his lantern slides. The question will be open for discussion afterwards.

Mr. Newstead: With regard to *Stomoxys calcitrans*, as I have stated in my paper, this insect has a very wide, and almost cosmopolitan distribution. Mr. Goodall, however, goes on to discuss certain "varieties." I do not quite understand what he means by varieties. A zoologist looks upon a variety as simply a dark or a light form of a species. What Mr. Goodall means exactly I cannot say, but the probability is that he means another and distinct species. There is, for instance, in South America *Stomoxys niger* which is one of the carriers of surra. But the one which is generally responsible for the transmission of that disease is undoubtedly *Stomoxys calcitrans*, an insect which occurs in almost all parts of the world. There are certain races of it. The African form, for instance, is slightly different to that which is met with in this country.

Then with regard to the life cycle of the Tse-tse, I have stated in my paper that it is pupiparous. That is a broad term, a term which

is generally understood by all Entomologists. That term is applied in the case of the Tse-tse fly owing to the fact that the larva is matured within the body of the parent and is extruded as a fully developed organism; it undergoes practically no transformation after it leaves the body of the parent. It wriggles about for a short time, and undergoes its transformation into the next stage, which is known as the pupal stage; therefore we apply the term pupiparous, a term which is also applied to that well-known group of pupiparous insects, the *Hippoboscidæ*, which includes the common forest flies. There you have an identical case The larva is developed within the body of the parent, but it certainly is extruded in a rather different form to that of the larva of Glossina, the Tse-tse fly. It is practically a pupa, but it also undergoes a change; it rapidly swells from a comparatively small object to a comparatively large one. So that you have a change in both cases. In the Tse tse fly you have a very marked change; in the true pupiparous insects, or the forest flies you have a less marked change. None the less the two may be described as being pupiparous. With regard to the flies, which he bred from the larvæ of the common vapourer moth, that is a fact which was known to science perhaps sixty or eighty years ago. It is a well-known fact also that many of the Diptera are parasitic in the larval stage.

With regard to the other part of the paper, there is very little time left, and I do not want to detain you, but I should like to say one or two words with reference to some of the ticks. I intended first of all to say something more with regard to the Tse-tse fly, and I asked the man to be here to work the lantern, but as he is not here I will dispense with the lantern. There is one point by which the tse-tse fly may be distinguished from any other known fly, and that is in the character of the neuration of the wing, the fourth vein being strongly curved in the centre. You can easily see it with the naked eye in the specimen I have here on exhibition. In addition to that you have also the biting mouth, parts which are again characteristic.

Then in regard to the ticks, we have fourteen species concerned in the distribution of piroplasma and two which are concerned in the transmission of spirilosis. We have spirilosis of the fowl transmitted by a species of *Argas*, and we have the relapsing fever in man produced by a species of Ornithodoros. Piroplasma bovis is transmitted by no less than four different kinds of ticks. I need not give a catalogue of all these species, it would only weary you; but there is one kind in America, another in Australia, and another different species in Africa, and in Europe there is the *Ixodes ricinus*. Taking the first three, those which transmit the disease in America, in Africa and in Australia, the tick passes the whole of its existence on one host; and the Piroplasma is said to be transmitted by the larval stage only, but interovum, in this way: that is to say a parent tick bites an infected ox, the

piroplasma (so we assume, because we have no proof of it) evidently passes from the parent through the egg into the larva when it becomes infective and is able to transmit the disease; but in the case of *Ixodes ricinus* perhaps both the males and females transmit the parasite. In this species of *Ixodes ricinus* you have a tick which lives upon three different hosts; so that in that case as the adult only transmits, you have the blood parasite, the piroplasma, passing through from the parent to the egg, the larva and so on until it reaches the adult stage of that generation *Piroplasma ovis*, the disease known as carceag, is transmitted by *Rhipicephalus bursa*. Here again you have a tick which requires three hosts, that is to say it has a larva which seeks a host, takes a fill of blood, leaves the host and undergoes its transformation, seeks another host, takes a fill of blood, leaves the host, and undergoes its second transformation; and a third time seeks another host, and in that stage it may, if infected, transmit the disease. Probably there are no less than four ticks concerned in the transmission of this disease (*Piroplasma ovis.*) In another Piroplasma (*Piroplasma canis*) three ticks are concerned in the distribution of the disease, the chief one being *Hæmaphysalis leachii*. There again the adult descendant, that is to say the parasite, the Piroplasma, apparently passes from one stage to another before it is transmitted to a healthy animal. You have a parent producing eggs—you have an infected tick producing eggs, eggs producing larvæ, nymphs and adults, but the disease is not transmitted until it reaches the third and final stage. Then there is a *Piroplasma parvum*, with three ticks which are responsible for its transmission, there is also *Piroplasma equi*. With regard to *Piroplasma equi* nothing is known. Three species are suspected of transmitting this disease, but nothing is known definitely about it. There are one or two more points which I had jotted down to speak to you about, but I am afraid I shall be detaining you if I refer to them. One was with regard to the tick which transmits the spirilosis of the fowl, and another which transmits the disease in man known as relapsing fever.

I think perhaps I have said sufficient to show, in the short paper which I prepared for this Association, with the addition of the few remarks I have offered here to-day, that ticks in both man and animals take a strange and a very unsatisfactory part in the distribution of the diseases fatal to man and to his domesticated animals. It only shows the great importance of treating infested land, particularly land in Africa which is known to be heavily infested with ticks, by firing if possible, and it is also extremely important to keep the ticks down by constantly dipping or spraying.

If there are any questions which you care to put to me during the limited time you have at your disposal, I shall be pleased to answer them. I take this opportunity, however, of thanking you very much indeed for giving me this opportunity of presenting a

paper to the Association. I have a paper here which will give you a fuller account of the mouth parts of the tsetse flies (*Glossina spp.*) which I shall be glad to present to the Association.

Prof. G. H. Wooldridge: In the first place I desire to thank Mr. Newstead for bringing the subject of this paper before us. A lot of the matter which he has mentioned is more or less familiar to all of us; comparatively little of it is new, but there are one or two points that I am not quite sure about, and there are also one or two things in the paper which I think require correction. With regard to the transmission of surra, Mr. Newstead says it is transmitted by the Stomoxys calcitrans, or at any rate that Stomoxys calcitrans is regarded as one of the carriers of surra. I should like to know if that is regarded by him as being the sole carrier of surra. I was under the impression that Tabanus tropicus had been *proved* to be one of the carriers of surra. That is also referred to in another paragraph lower down on the page in which he says "It is highly probable that the gad flies (Tabanidæ) and the forest flies (Hippoboscidæ) are also effective carriers of Trypanosomiasis, but the evidence, so far, is of a circumstantial nature." With regard to Tabanus tropicus perhaps that may apply—I am not quite sure on that point, but there is one other Trypanosomiasis which I think has been definitely proved to be carried by one of the Hippoboscidæ. I refer to a disease of cattle in South Africa which is known as gall sickness, or galziekte, which is produced by a trypanosoma discovered and investigated very fully by Theiler. Theiler has put it on a very firm basis that that disease is transmitted by the Hippobosca rupifes, so that the evidence is not of a circumstantial nature; it is definite on that point. There is one other thing I would like to ask Mr. Newstead which he has not referred to in connection with injurious cutaneous parasites, viz., common warbles. We occasionally meet with warbles in the horse. The Hypoderma Loisetti is found under the skin of the horse, and so far as I know nothing has been discovered with regard to the adult stage of that parasite. It resembles in some ways the other hypodermas. It is smaller, perhaps, and a little longer than that found under the skin of cattle, and the same applies in comparison with the one found in the stomach of the horse, the Gastrophilus equi. The position of the parasite would indicate that it might get there in two ways—by being inoculated subcutaneously directly, or by the larvæ being licked off and passing through the tissues from the stomach to their predilection seats. We know that the ordinary bot of the horse does get to its predilection seat in the stomach by licking, but we do not know how this hypoderma gets under the skin of the horse. Judging by analogy with Hypoderma Bovis I should say it is very probably one of the known Œstridæ of the horse which has gained an unusual position, either the larva of the Œstrus Equi or of the Œstrus Hæmorrhoidalis. I am not quite sure of that, and I should like to know if Mr. Newstead has any information to give us on the subject.

Reply by Mr. Newstead.

Mr. Newstead: With regard to Prof. Wooldridge's questions, I think you will remember that I did make a statement as to two species of Stomoxys being concerned in the distribution of surra. In addition to the Calcitrans, we know for a fact that Niger is also a pathogenetic species. Then with regard to Tabanus tropicus, we in Liverpool are not quite certain about that. We look upon the evidence as more or less circumstantial. We do not think it has been fully proved that Tabanus tropicus is the carrier of that disease. It may be, and a number of other flies may also be, but I did not think it wise to make that statement, because we look upon the evidence, as I have already said, as being of a more or less circumstantial character. It was an omission on my part not to refer to the Trypanosomiasis, and the work of Dr. Theiler. I ought to have said that Theiler claims that Hippobosca rupifes is a carrier of Trypanosomiasis. (Prof. Wooldridge: It has been proved.) It has been proved, I believe. That was an oversight on my part, and I am glad you have called my attention to it. With regard to the Œstridæ, the species which you have met with in the horse is also met with more or less freely in Ireland, I refer to the warble in the horse. I have only quite recently obtained a couple of specimens, in fact one of the students attending the last course of instruction here very kindly handed over to me two larvæ which he obtained from horses in Ireland, and although I have had them for three or four weeks, I have not been able to make a careful examination of the external characters. I think in all probability the external characters will afford some clue as to the correct identification of this somewhat obscure insect, or rather larva. What it really is I cannot say. We know it has a definite name, but whether it is one or other of the better known flies I cannot say. The thing to do, of course, would be to get a quite matured larva from the host and rear it if possible. It is always difficult to rear these bot flies, but still if we had half-a-dozen or more fully matured larvæ we might settle the question; the larvæ may afford specific characters, and I shall be very glad, if I am able to do so, to give you any particulars with regard to those characters.

Prof. G. H. Wooldridge: I beg to propose a very hearty vote of thanks to Mr. Newstead for his interesting paper.

Mr. A. J. MacCallum: I beg to second that.

The resolution was put and carried with acclamation.

Mr. Newstead: Mr. Chairman, Prof. Wooldridge and gentlemen, I am extremely obliged to you for your kind vote of thanks. I should like to take this opportunity of apologising for the very brief paper I prepared for discussion here to-day. I did not understand that I should be required to write a paper, and at the last moment I was asked to do something. I was very much pressed for time, it being the end of the term when all our examinations take

place; but if it has in any way interested your members, and if I have made any remarks which are of use or value, I shall feel perfectly satisfied.

The CHAIRMAN: Mr. Newstead has been good enough to present to the Association a copy of his joint work on the anatomy of the proboscis of the bloodsucking flies (Pt.1 *Glossina*). I will hand the book to our Secretary to take care of.

Mr. NEWSTEAD: Your Secretary has suggested to me, sir, that we in Liverpool might be of some service to the members of the Association in the way of identifying the external parasites of animals. I can only speak for my own department, namely, that of Entomology and Parasitology; but if you care to send me any material, I shall be glad to examine it and report upon it. I am particularly interested at the present moment in the various kinds, or varieties, of acari, peculiar to the horse, and if you could send me some material I shall not only feel grateful but I shall find it of very great value to the gentlemen who come here and take the course in Veterinary Science. (Cheers.)

VOTES OF THANKS.

Mr. PRICE: I beg to propose a very hearty vote of thanks to the University authorities of Liverpool for so kindly placing at our disposal the use of these rooms for the holding of our meetings, the opening of the museum, and for the great kindness they have shown to us during our visit.

Mr. F. G. SAMSON seconded the motion, which was carried with acclamation.

Lieut.-Col. C. STEEL: It goes without saying that we all regret the absence of our President, and I am sure we all wish him a speedy return to health. The importance of his presence is illustrated by the fact that it has taken three gentlemen to carry out his duties; and it therefore affords me very great pleasure to propose a hearty vote of thanks to Mr. Abson, Prof. Mettam and Mr. Hedley for presiding over the various meetings of the Association.

Mr. A. L. BUTTERS: It affords me very great pleasure to move a vote of thanks to those gentlemen who have so kindly opened the discussions on the papers that have been written, and who in doing so have contributed so much to the enlightenment of the subjects brought before us. I should like to include the writers of the papers in this vote of thanks, but I understand that votes of thanks have already been passed to them, to a certain extent. The writers of the papers are men of eminence in their professions, and they have been so kind as to place the benefit of their large observations before us. With regard to Prof. Boyce, it has often been said that those who look on see more of the game than those who play it, and I think that applies in some respect to the position which Prof. Boyce has occupied to-day. He is outside of the profession, but he is a keen observer and much interested in it, and I am sure the

profession has benefited by his remarks. The same remark applies to Mr. Newstead, whose great knowledge and learning on this particular branch of the subject have been laid before us. I have much pleasure in proposing a vote of thanks, not only to the writers of the papers, but to those gentlemen who have opened the discussions.

Mr. J. S. Lloyd: I have very much pleasure in proposing that best thanks of this meeting be given to the Provisional Committee and to the Local Secretary, Mr. Arnold Richardson. We all know the hard work that is connected with such a meeting as this, and that it would be quite impossible for it to be a success unless we had a good Local Provisional Committee, and good Local Secretaries.

The Chairman: I have allowed the business to proceed in a somewhat irregular fashion. Generally speaking, when a motion is made it ought to be seconded, so I beg to second all the motions which have been moved, including the one which proposed a vote of thanks to myself.

The resolutions were then put and carried with acclamation.

The meeting then terminated.

THE ANNUAL DINNER.

The Annual Dinner was held at the Adelphi Hotel on Wednesday evening, July 25th, the chair being occupied by Prof. A. E. Mettam, who was supported by a large company, including many ladies, among those present being Mr. Caroe, Danish Consul at Liverpool; Prof. Bang, Copenhagen; Prof. Boyce, Dr. Hope, Medical Officer of Health, Liverpool; Dr. Mussen, and Messrs. J. Abson, H. Sumner, Stafford Jackson, J. Share-Jones, and Arnold Richardson.

The usual loyal toasts were duly honoured.

The toast of "The Imperial Forces" was proposed by Mr. Hedley, Dublin, and responded to by Major A. W. Mason, Leeds.

Prof. Boyce, in proposing the toast of "The National Veterinary Association," said he did so in a triple capacity, first, on behalf of his colleagues in the University, secondly, on behalf of his colleagues working for the corporation of Liverpool, and thirdly, as President of the Liverpool University Veterinary Medical Society. He could not help feeling that the Association could do a great amount of good, its particular function in Liverpool being to unite the various units of the profession for the common progress of veterinary science. During its meetings very important discussions took place on points of general and special interest; and in that respect he could not help likening it to its sister Society, the British Medical Association, whose work had been of inestimable service to the medical profession. The Veterinary School at the Liverpool University desired the cordial co-operation and good will of the Association, because it wished to promote the very highest veterinary training.

Mr. Wm. Hunting, in responding to the toast, thought the Association by meeting annually in the provinces and discussing three or four papers, did a great deal of good, because most of the members had their erroneous impressions on professional subjects corrected, and went away from the meetings wiser than they came. The social side of the Association was of great value, because it increased friendships and broke down prejudices. The fact that the ladies were now admitted to the meetings had practically resuscitated the Association, which, before their introduction, was in danger of dying a natural death. It was particularly gratifying to him that the toast had been proposed by Prof. Boyce. The opponents of the establishment of the Veterinary School at Liverpool were now grateful that it had been brought about ; they recognised that Prof. Boyce's efforts were well placed, and those who had been beaten recognised that he was a better man than any of them. He was certain the veterinary profession might always rely upon the assistance of Prof. Boyce in any movement which had for its object the advancement of the profession. (Cheers.)

Mr. Henry Sumner, in proposing the toast of "The Visitors," alluded to the presence of their distinguished *confrère*. Prof. Bang, who came from a country which has given England the woman of all women, the Queen. The Danes had prospered in agricultural matters in a marvellous manner, and were an outstanding lesson to English people of what could be done by thrift, frugality, and co-operation. He hoped the day was not far distant when the people of the Midlands and of the Broad Acres would come to the conclusion that agricultural prosperity in this country could be regained by the breeding of milch cows and the production of milk.

Prof. Bang, who received a very cordial welcome on rising to respond, in a brief speech emphasised the fact that England was the best friend of Denmark, and that the people of Denmark had nothing but love for the people of this country.

Mr. Caroe (Danish Consul at Liverpool), who also responded, referred to the extraordinary progress Denmark had made in everything connected with agriculture. Thirty years ago the people of the country were distinctly poor but now by their wonderful system of co-operation they were in an exceedingly prosperous condition.

Dr. Hope (Medical Officer of Health, Liverpool) also responded.

The toast of "The Ladies," was proposed by Prof. Wooldridge, and responded to by Prof. John McCall; and the health of "The Chairman and Mrs. Mettam" was heartily drunk, Col. Steel proposing the toast.

The Chairman briefly acknowledged the compliment.

LIST OF MEMBERS OF THE NATIONAL VETERINARY ASSOCIATION, 1906-7.

Those marked (*) are Life Vice-Presidents.
,, ,, (1) have served as President,
,, ,, (2) ,, as Vice-President.
,, ,, (3) ,, on the Council.
,, ,, (4) ,, as Treasurer.
,, ,, (5) ,, as General Secretary.
,, ,, (6) ,, on Provisional Committee.
,, ,, (7) ,, as Local Secretary.
,, ,, (8) ,, written papers for discussion.
,, ,, (9) ,, opened discussions.
(F) signifies Fellow of the Royal Coll. Vet. Surgeons.

Abson, J. (F) (2, 3, 6, 7) Surrey Street, Sheffield
Aitken, John, Junr., Dalkeith
Allen, Chas. (F) (* 1, 2) Dublin
Almond, N. (F) (8) Cambridge House, Kingston-on-Thames
Ascott, Wm. (6) Bideford
Atcherly, Jas. (6) Harrogate
Auger, A. S., Saxmundham
Auger, T. E., Wymondham, Norfolk
Awde, W. (F) (2, 3, 6) Stockton-on-Tees
Axe, J. W. (* 1, 2, 6, 9) The Wilderness, Pinner, Middlesex
Baird, A., York Lane, Edinburgh
Baker, E. W., Wimborne. Dorset
Banham, Geo. A., (F) (2, 3, 5, 6, 7, 8), Cambridge
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Barling, F. W., (3, 6) New House, Ross, Herefordshire
Barrett, W. F., 46 Lewisham High Road, S.E.
Batt, T., (6) 469 Oxford St., London
Beart, W. J., King's Lynn, Norfolk
Beckett, A. J., (6)
Beddard, E., (F) (2, 3) Cleveland Road, Wolverhampton
Bell, John J., (2, 3, 6) Carlisle
Berry, A. H., 10 Atherfold Street, Clapham Road, S.W.
Blackhurst, C., Broughton, Preston
Blakeway, Jno., (F) (6, 7) Birmingham
Bloye, W. H. (F) (* 1, 2, 3) Ebrington Street, Plymouth
Bond, P. G., (6, 7) Plymouth
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Bowden, A. Cornish, 127 High Street Beckenham
Bower, Wm., (* 1) East Rudham, Norfolk
Bowes, H. G., 29 Blenheim Terrace, Leeds
Bowhill, T., Bacteriological Institute, Graham's Town, Cape Colony
Bowman, G. E., (6) Woodhouse Lane, Leeds
Bradley, O. C., (7) Veterinary Coll., Edinburgh
Bray, C. T., (6) 139 Fordwych Road, West Hampstead
Broad, Alf., (F) (3, 6) 8 Finchley Road, St. John's Wood, London
Broad, Arthur, 39B Goldhawk Road, Shepherd's Bush, London
Brooke, W. H., (6) Handsworth, Birmingham
Brooks, H., Leadenham, Lincoln
Burchnall, J. J., (6) Loughborough
Burrell, T., (6) 50A Brewer Street, Regent Street, London
Butler, E. R. C., (F) Major, A.V.C., (3, 9), Aldershot
Butters, A. L., (3) 31 South Wharf Road, Paddington
Byrne, W. A., (2, 3, 8) Roscommon
Cameron, J., Bridge Street, Berwick
Campbell, — Health Department, Town Hall, Llanelly
Carless, W., (2, 3, 6) Eastgate Street, Stafford
Carless, W. S,, (2, 3) Worcester
Carr, F. U.. Capt. A.V.C., Haworth, Yorks
Carter, J. H., (F) (2, 3, 6) Burnley
Carter, J. T., Potter, Craigleith, Christchurch Road, Malvern
Caton, H. W., (F) 413 Mile End Rd., London, E.
Caudwell, W., (F) 20 London Street, Chertsey, Surrey
Challinor, C. E,, (F) (6) Pendlebury
Chesterman, T. G., (6) Leman Street, Whitechapel, London
Chivas, A., Corbridge-on-Tyne
Clark, J., (F) (3, 6, 8) Abbey Hill, Coupar Angus, Perthshire
Clifford, C. J., Vet. Dept., Dublin
Cockburn, R., (6) Eastwood, Notts.

Coe, J. W., (F) (3, 6, 7) Stoke-on-Trent, Staffs
Connell, J. A., Lichfield
Connochie, T D., Galashiels
Constable, D., (3, 6) Inchture, Perthshire
Cooke, J., (F) (6) 14 Elders Street, Scarborough
Craig, Prof. J. F., M.A., Royal Veterinary College, Dublin
Crowhurst, E. G., (F) Leamington
Cunningham, C., (2, 3) Slateford, Midlothian
Cureton, W., Tenbury, Worcester
Daly, J., (6) Dept. of Agric., Dublin
Daly, J. V., (3) Bo-Peep Island Bridge, Dublin
Darwell, A. H., (3, 6) Northwich, Cheshire
Davies, D. G., (2, 3) Swansea
Dawes, H. J., (F) (3) West Bromwich
Dawson, W., (6) Cavan
Denington, W., 5 Neville Terrance, S. Kensington
Dewar, J. R. U., (F) (* 1, 8, 9), Prin. R.V,C., Clyde St., Edin.
Dixson, E. L, 11 Grosvenor Place, Margate
Dobbyn, A., (2, 3, 6) Waterford
Dollar, Jno. A. W., (6, 8) } 56 New Bond
Dollar, T, A. } St., London
Doris, J., Cookstown, Co. Tyrone
Douglas, T, A. (6) Kilmarnock
Drabble, C., (3) Bradford
Drinkwater, T., Buxton Road, New Mills, Stockport
Duck, F., (F) C B., Colonel A.V.D. Holm Leigh, King Charles Road, Surbiton
Duckworth, T. H. L., Ashbourne, Derbyshire
Dudgeon, G. R., (3, 6) Sunderland
Dunlop, J. B., (6) Ailesbury Rd., Dublin
Dunne, G., 102 Upper George Street, Kingstown, Co. Dublin
Dunstan, J., Prof. (6, 8) Royal Dick Coll., Edinburgh
Edmondson, W., Wansford House, East Parade, Harrogate
Edwards, E. R., Board of Agriculture
Edwards, F. G., (3, 6) Chester
Edwards, W. T., Windsor Rd., Neath
Elder, G. H., Taunton
Elder, W. A., Matthews Green, Wokingham
Elphick, G., (2, 3, 6) 67 Newgate St., Newcastle-on-Tyne
Faulkner, Ed., (* 1, 3, 6, 8) Knott Mill, Manchester
Fletcher, T. C., Ellin Street, Sheffield
Foreman, T., East House, Leadgate, R.S.O., Co. Durham
Forsyth, A. B,, Cannock
Freeman, R. B., (2, 6) Harry St , Dublin
Freer, B., (6) Uppingham, Rutland
Frost, T. A., High Street, Hounslow
Garnett, F. W., J.P., (* 1, 3, 9) Windermere
George, J., Magherafelt, Londonderry
Gibbings, G. H., (F) (6) Tavistock
Giblin, M, T., (6) 3A Oldham Road, Rochdale
Gooch, F. L., (F) (2, 3, 6) St. Martin's Stamford
Goodall, T. B., (F) (9) Christchurch, Hants
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Grasby, W., (6) Daventry
Gray, H., (6, 8, 9) 23 Upper Phillimore Place, Kensington, W.
Griffin, R. Fairgate, Drogheda
Hall, H., St. James Road, East Grinstead
Hamilton, D., Bourtreehill, Hamilton
Hammond, John, Bale, Melton Constable
Hancock, W. A., (3, 6) Clowden House, Uxbridge
Harding, E. R., Salisbury
Hartley, Chas. (F) (3, 6) Lincoln
Harvey, F. (F) (8) St. Columb, Cornwall
Haywood, Chas., Millsbone Lane, Leicester
Healy, J. F., (2, 6) Midleton, Co. Cork
Heatley, T. G., Woodbridge
Hedley, M., (F) (* 1, 2, 3, 7) 6 Royal Terrace, Kingstown, Dublin
Heelis, L. W., Solihull
Henderson, J., 98 Gilmore Place, Edinburgh
Hepburn, W., Coldstream
Hewson, Frederick (6) Royston, Herts.
Hoare, E. W., (F) (2, 6, 8) 18 Cook St., Cork
Hobday, F., (F) (3, 7, 8) 10 Silver Street, Kensington, W.
Holburn, A., (6) Abattoirs, Manchester
Holland, J., (6) Athy, Co. Kildare
Holmans, S. E., Park Lodge, Lee Green, Kent
Hopkin, Tedbar, (F) (2, 3, 6, 9) 15 New Bridge St., Strangeways, Manchester
Houston, W. F., (3) Paisley
Howard, C. W., 43 High St., Dorking
Howard, P. J., (2,3,8) Ennis, Co. Clare
Howard, P. S., (F) "Windermere," Cambridge Park, Wanstead, Essex
Howe, G., (3, 6) Buxton
Howse, Henry, Lincoln
Huband, T. A. (F) (2) 13 Albion Street, Cheltenham
Hughes, R., (F) (2, 3, 6) Willow Street, Oswestry

Hunter, H., (2, 3, 6, 9) New Bridge Street, Newcastle-on-Tyne
Hunting, C. S., South Hetton, Durham
Hunting, W., (F) (* 1, 3, 5, 6, 8, 9) 16 Trafalgar Sq., Chelsea, S.W.
Hurndall, J. S., (2, 3, 6, 8, 9) Launceston Place, Kensington
Hutton, J., (F) (6) Pringle Bank, Kelso, Roxburghshire
Inglis, T. M., Forfar
Ison, W. E., Atherstone
James, J. C., (F) Thornbury, Glo'ster
James, W. H., Frome
Jermyn, W. R., Clifton, Bristol
Johnson, A. A., (F) Campbell Road, Twickenham
Johnston, J. E., May Street, Belfast
Jones, C., (6) Vet. Dept., Dublin
Jones, J. T. Share, Liverpool University
Jones, R., Towyn, Merionethshire
Jones, T. Eaton, (6, 9) Municipal Builds., Liverpool
Jowett, W., (F) (6) Pathological Laboratory, University of Liverpool
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King, G. E., (3) The Vineyard, Abingdon
King, H., (6) 155 Lower Kennington Lane, S.E.
King, J., (6, 8, 9) Islington Market, London
Laithwood, James, (F) (3) Congleton
Lambert, R. H., (6) 47 South Richmond Street, Dublin
Lambert, T. D. (F) (2, 3, 6) 47 South Richmond Street, Dublin
Langford, E., (6) Shaftesbury
Latta, J., (7) Hartley Street, Ulverston
Lawson, A., Manchester
Lawson, J., Manchester
Leach, E. H., (F) Newmarket
Leigh, F., (F) Cheriton, Westbury-on-Trym
Lepper, H. G., (3) Aylesbury
Levie, A., Broad Street, Nottingham
Little, W. L., South Town, Great Yarmouth
Lloyd, J. S., (6, 8, 9) Town Hall, Sheffield
Locke, G. H. } Grosvenor Street,
Locke, S., (2, 3, 6) } Manchester
Lomas, S., Wilmslow, Manchester
Lowe, G. C., Oxley Street, Dockhead, S.E.
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McCall, J., (F) (* 1, 2, 3, 8, 9) Principal, Vet. College, Glasgow
McCall, J. R. Buccleuch Street, Glasgow
McCall, James McI., (3) Board of Agriculture, 4 Whitehall Place. S.W.
McCallum, A. I., (3, 6) 30 Kings Stables Road, Edinburgh
M'Fadyean, Sir John, (F) (* 1, 2, 3, 8, 9) Principal R.V.C., London
Macfarlane, D., (3) Doune, Stirling, N.B.
McGavin, James, (2, 3, 9) Montgomery
McGowan, J. A. B., Capt. A.V.C., The Barracks, Leeds
Macgregor, W. A., 3 Castle Hill Rd., Ayr, N.B.
Mackinder, J. (F) (* 1, 3, 6) Peterborough
McKenny, J., (2, 3, 8) Dublin
McKinna, Jno., (F) (3, 6) Huddersfield
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If any errors occur in the above list please communicate with the General Secretary, W. HUNTING, 16 Trafalgar Square, Chelsea, S.W.